Essays on the behavior of foreign banks in Brazil

Nazar van Doornik, B.F.

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

Essays on the Behavior of Foreign Banks in Brazil

Essays on the Behavior of Foreign Banks in Brazil

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan Tilburg University op gezag van de rector magnificus, prof.dr. E.H.L. Aarts, in het openbaar te verdedigen ten overstaan van een door het college voor promoties aangewezen commissie in de Ruth First zaal van de Universiteit op dinsdag 2 juni 2015 om 10.15 uur

door

Bernardus Ferdinandus Nazar van Doornik,

geboren op 23 april 1981 te Belo Horizonte, Brazilië.

PROMOTOR:

prof. dr. L.D.R. Renneboog

COPROMOTOR:

dr. O.G. De Jonghe

OVERIGE COMMISSIELEDEN:

prof. dr. L.R. Capelletto

prof. dr. H. Degryse

prof. dr. V. Ioannidou

dr. F. Braggion

dr. M.F. Penas

Acknowledgements

I am grateful to the many people that have supported me in writing this dissertation. I thank Luc Renneboog for accepting me in Tilburg University and for his invaluable support and elegance in helping me to complete the doctorate. I would like to thank Hans Degryse, Vasso Ioannidou and Olivier De Jonghe for their great academic guidance, and I hope I can continue writing with them in the future. My gratitude also goes to Lucio Capelletto in the name of the institution of the Central Bank of Brazil for accompanying me during my voyage for the search of knowledge. I thank the other members of my PhD committee for the valuable comments and advices that greatly benefitted my work.

It has been an honor to pursue my doctorate at the Finance department in Tilburg. This is my opportunity to thank my fellow PhD students, colleagues, and friends for the good moments we had in the past years. Anton, Çisil, Jiehui, Larissa, Paola, Radomir, Turan and Yaping are special among a group of great, inspirational and fun people.

This thesis would not have existed if it were not for the support from my family. My parents and brother were a constant source of unconditional love, encouragement, and support over the years. I am immensely grateful to them. My sweetest acknowledgements are saved for the love of my life. I need to thank my wife Marisol for giving me ultimate strength and for making my journey more beautiful!

Bernardus F. Nazar van Doornik

Brasília, Brazil

May, 2015

Table of contents

Preface

This Ph.D. dissertation consists of three essays on the behavior of foreign banks in Brazil. The first chapter explores the Brazilian macro-prudential measures of the end of 2010 in order to unfold the lending behavior of foreign banks. The second chapter evaluates the extent to which the international financial crisis that started in August 2007 induced more affected banks to act in a more pessimistic way on the creditworthiness of their commercial borrowers. The third chapter analyses how the strengthening of creditor rights affected corporate debt structure and collateral agreements, following the 2005 bankruptcy law in Brazil.

Chapter 1: The Cross-Market "Flight to Quality" Substitution Effect on Lending

By operating in multiple countries, foreign banks can transmit negative economic shocks to local lending, aggravating the contagion from one market to another. However, foreign banks can increase local lending if an adverse outside shock reduces the expected profitability of lending in the markets that experienced the shock (Berrospide, Black and Keeton, 2013). In this case, foreign banks can reallocate capital due to their internal capital markets, helping to insulate local economies from outside loan supply shocks (Morgan, Rime and Strahan, 2004).

In this chapter, we identify whether and how, during liquidity tensions in their country of origin, foreign banks substitute their investments with lending in Brazil. We focus our analysis on the rise of the sovereign crisis in Europe (outside adverse shock) and exploit the Brazilian macro-prudential measures on the fourth quarter of 2010. In order to control the fast credit growth, the macro-prudential measures decreased the incentives for banks in Brazil to fund themselves locally and abroad, with the exemption of equity investments. Exploiting the macro-prudential measures in a quasi-natural experiment, we investigate its effects on the differences in credit supply, willingness to start (terminate) new (ongoing) bank–firm relationships, and the shift in risk-taking lending strategies over the transition from 2010 to 2011.

Results show that foreign banks increased their supply of credit after the macroprudential measures when compared with the level of the private domestic banks. Despite the spillover effects that foreign banks could have received through their bank's balance sheets, we find that the more

exposed a foreign bank was to the sovereign crisis, the more they substituted with lending in Brazil. We also investigate the extensive margin of the willingness of foreign banks to start new bank–firm relationships and to terminate ongoing lending relationships over transition from 2010 to 2011. Taken together, the results of "entry" and "exit" rates of firms suggest that foreign banks were more relationship intensive, whereas private domestic banks more concerned with extending relationships further.

In order to formally test the "flight to quality" hypothesis, we distinguish groups of firms with opposing credit risk. In all tests, we find that foreign banks intensified credit supply to low-risk firms to a greater degree than other bank groups. We also test whether foreign banks increased lending via the internal capital markets channel. Results suggest that changes in equity have a sizeable effect on lending. We interpret our findings as evidence that the substitution effect for Brazil operated through the capital channel.

Chapter 2: The internal credit rating channel.

Banks may have a competitive informational advantage over alternative lenders. Apart from having access to public information, banks also possess private information derived from the transaction accounts of borrowers. The purpose of the collection and process of information is to create a measure to assess and monitor the credit risk of a firm. This measure is embedded in a credit rating, and it represents an assessment of the likelihood that a firm will default on their debt obligations in a given period.

However, there is skepticism about the capacity of foreign banks to collect and process information. It is possible that foreign banks are not well suited to collecting "soft" information about borrowers (Stein, 2002; Canales and Nanda, 2012). Difficulty in collecting soft information on the local market may be especially acute when foreign subsidiaries are far from bank headquarters (Berger and DeYoung, 2006; Mian, 2006). Moreover, foreign banks may revise their perceptions of an entire class of loans based on losses in only some of the countries in which they operate (Van Rijckeghem and Weder, 2003).

In this chapter, we test the hypothesis of whether an outside adverse shock affects banks in a heterogeneous way, inducing foreign banks in particular to become more pessimistic about the quality of local borrowers. If this is true, we should be able to capture such behavior through the

bank's internal credit ratings. Using a panel-data sample from the Brazilian credit registry with quarterly credit data for more than 500.000 firms from 2005 to 2009, we find that the international crisis of 2007-2008 did have an effect on the risk assessment of firms. On average, foreign banks were more aggressive in downgrading their borrowers in comparison to private domestic banks during the crisis. Additionally, our results suggest that the more banks were affected by the crisis, the more they became pessimistic about the creditworthiness of firms in Brazil. This is in line with the idea that a decrease in the quality of borrowers in other markets may cause foreign banks to become more pessimistic about the quality of local borrowers (Berrospide, Black and Keeton, 2013).

One of the characteristics of the Brazilian credit registry is that banks do not have access to the credit rating assigned by other banks. Therefore, concerns about the potential triggering of a systemic downgrading of credit ratings are almost discarded. However, the question we raise in this paper could be particularly relevant for countries where credit ratings are shared among banks through public credit registries. If international risks can indeed be transmitted to a local market through the credit rating channel, then public credit ratings may exacerbate lenders' coordination and increase the incidence of firm financial distress (Hertzberg, Liberti and Paravisini, 2011).

Chapter 3: Collateral after the Brazilian Creditor Rights Reform

"One of the key channels through which financial development operates is by lowering the demand for collateral" (Liberti and Mian, 2010). However, protecting creditor rights, which is also linked with financial development, is documented as increasing secured debt use (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998; Levine, 1998, and 1999; Djankov, McLiesh, and Shleifer, 2007). The reforms brought by the Brazilian bankruptcy law (Law 11,101/2005) significantly strengthened the rights of secured creditors by giving them a higher priority when it comes to accessing the assets of the bankrupt firm. It also allowed banks to bypass the lengthy judicial process for seizing and liquidating the certain types of collateralized assets of the defaulting firm.

Exploiting the bankruptcy law in a quasi-natural experiment, we investigate its effects on three aspects of collateral. Namely, we focus on corporate debt structure (macro-level), on the use of collateral agreements with different liquidity levels, and on the amount of collateral pledged in order for a firm to access new credit (micro-level). Using a panel-data sample from the Brazilian

credit registry with quarterly credit data for more than 790,000 firms from 2004 to 2005, we find that secured debt increased after the reform. Moreover, we document that the law increased the use of all types of security interests. In particular, we find evidence that the law had a bigger effect on the use of more liquid collateral agreements.

Additionally, we show that a reform that strengthens secured creditor rights has a mixed effect on borrowers, depending on their previous level of collateral pledged. Collateral pledge significantly decreases for those borrowers who previously had to pledge collateral in excess of the value of the loan; and it significantly increased for those borrowers with a lower level of collateral pledged before the reform. We show that firms negatively affected by the reform might be able to lighten the extra burden of having to pledge more collateral. Borrowers in a multiple banking setup could at least mitigate the effect of the reform by contracting with foreign-owned banks. Our findings are based on a careful classification of borrowers in order to disentangle the bank's demand for security interests from the firm's supply of collateralizable assets. Although the role of foreign banks is controversial, our paper documents foreign banks as promoters of financial development.

Chapter 1. The Cross-Market "Flight to Quality" Substitution Effect on Lending

Bernardus F. Nazar van Doornik
Hans Degryse
Vasso Ioannidou
Olivier de Jonghe

Abstract

Coinciding with the rise of the sovereign crisis in Europe, we exploit the Brazilian macro-prudential measures of the end of 2010 in a quasi-natural experiment to unfold the lending behavior of foreign banks in Brazil. Using a large dataset from the Credit Registry, we are able to isolate the credit supply channel and control for changes in borrower demand, quality, and other types of shocks to banks' balance sheets. We find that foreign banks increased credit supply in Brazil by six percentage points above the level of private domestic banks. In our most conservative specifications, European banks and particularly banks from the GIIPS countries amplified local credit to a greater extent than other foreign banks did. Our findings are consistent with the view that adverse outside shocks induce those banks that are hit on their home markets to substitute with more profitable markets. The substitution effect is also observed as a "flight to quality" inside Brazil, given that foreign banks increased lending to low-risk firms to the detriment of high-risk firms to a greater extent than domestic banks did. Finally, we document that bank's internal capital market appears to be one of the channels for the substitution effect.

JEL Classification: E44, E51, F34, G21.

Keywords: lending relationships, credit supply, foreign banks, sovereign crisis, substitution effect, flight to quality, internal capital market.

1 – Introduction

On one hand, foreign banks can increase local lending if an adverse outside shock reduces the expected profitability of lending in the markets that experienced the shock (Berrospide, Black and Keeton, 2013). In this case, foreign banks can reallocate capital due to their internal capital markets, helping to insulate local economies from outside loan supply shocks (Morgan, Rime and Strahan, 2004). We refer to the tendency of an adverse outside shock to cause foreign banks to increase local lending as the *substitution effect.* On the other hand, by operating in multiple countries, foreign banks can transmit negative economic shocks to local lending, aggravating the contagion from one market to another. We refer to the alternative possibility (*i.e.*, that an adverse outside shock causes foreign banks to decrease local lending) as the *spillover effect*.

In the light of these seemingly opposite effects, we address the questions of whether and how foreign banks substitute their investments during liquidity tensions in their country of origin by lending in another, supposedly more profitable, market. We focus our analysis on the rise of the sovereign crisis in Europe (outside adverse shock), and use Brazil as a potential local market for the substitution effect. Evidence shows that Brazil was being flooded with foreign resources in 2009 and 2010, where excessive short-term capital inflows were exacerbating domestic credit growth (Silva and Harris, 2012). Indeed, local credit continued through a cycle of rapid expansion, with an approximately 20% increase in 2009 and 2010.

However, in order to find strong evidence for the substitution effect using a differences-in-differences approach, we should be able to observe foreign banks increasing credit supply to a greater extent than domestic banks. This was not the case before the fourth quarter of 2010. The lending dynamics of foreign and domestic banks had similar trends. This is not surprising, since on the liability side of their balance sheets foreign, private domestic, and government banks had at least three channels through which to increase credit supply: domestic funding (*e.g*., local deposits and interbank deposits), international funding (*e.g.*, international interbank deposits, bonds issued abroad), and equity (*e.g.*, new shares).

In order to deal with the excessive speculative capital inflows that were exacerbating domestic credit growth, in December 2010 the Central Bank of Brazil enacted macro-prudential

measures increasing the reserve requirements for domestic[1] and international funding[2]. In March 2011, the Ministry of Finance raised taxes on international funding[3]. These measures represented a negative shock to local credit supply, because they made funding more expensive to banks in Brazil. However, since the requirements for foreign equity investments remained the same throughout the sample period, during this time banks could still operate in the credit supply market using this channel. We expect foreign banks to be particularly incentivized to use the equity channel because of the higher bonds between the foreign parent bank and its local subsidiaries. If it is true that foreign banks indeed had higher incentives to substitute with lending in Brazil, we should be able to capture this substitution effect more clearly after the macro-prudential measures.

Hence, we exploit the Brazilian macro-prudential measures in the fourth quarter of 2010 in a quasi-natural experiment to unfold the substitution effect of foreign banks on lending. We focus on the differences of credit supply, willingness to start (end) new (ongoing) bank–firm relationships, and the shift in risk-taking lending strategies over the transition from 2010 to 2011. We apply a differences-in-differences methodology, comparing the dynamics of our variables among three different types of bank ownership – foreign, private domestic and government owned banks – operating in Brazil before and after the end of 2010.

We have the appropriate data for testing the effects of the euro sovereign crisis on local lending after the macro-prudential measures. We use a panel data sample from the Brazilian credit registry, which consists of quarterly credit data for more than 960,000 firms from 2009:Q4 to 2011:Q3, where firms are observed in the pre- and in the post-period. The data allow us to identify banks, firms, and loan information over time. Overall, there are more than 10 million firm–bank–time observations. The unique quasi-natural experiment combined with the comprehensive dataset enables us to address the econometric identification challenges.

We first test whether foreign banks were able to increase *Lending* in Brazil during the rise of the sovereign crisis and after the macroprudential measures. We find that foreign banks increased the supply of credit by six percent in the post-period. Despite the spillover effects that

[1] Unremunerated reserve requirement on term deposits was raised from 15% to 20%; and additional remunerated reserve requirement on demand and term deposit was raised from 8% to 12%.

[2] Unremunerated reserve requirement on banks' short positions in the foreign exchange spot market was raised from 0% to 60%.

[3] Tax on Financial Transactions (IOF) of inflows related to direct external borrowing and debt securities issued with a maturity below 360 days (before the average tenor was below 90 days) was raised from 5.38% to 6%.

foreign banks could have received through their bank's balance sheets, we find that the more exposed a foreign bank was to the sovereign crisis (European banks and banks from GIIPS countries in particular), the more they substituted with lending in Brazil. The identification strategy relies on a comparison between the behavior of foreign banks and other banks (private domestic and government owned). We select firms that borrow from at least one foreign bank and from one other bank (private domestic or government owned) in the pre- and in the post-period. We account for differences across types of banks (foreign, domestic and public), across settings of fixed effects (firm, time and bank FE, or firm−time and bank FE) and differences within bank's balance sheet structure.

In an extensive margin analysis, we also find that foreign banks were less willing to start new bank−firm relationships when compared with private domestic banks, and more willing to end ongoing lending relationships over the transition from 2010 to 2011. The result for both the "entry" and "exit" rates of firms suggest that foreign banks were more relationship intensive (*i.e.*, concentrating on some relationships and less supporting of fragile borrowers), whereas domestic banks were more concerned with extending relationships. Results are in line with Bofondi *et al*. (2013), who interpret this finding as a "flight to quality" of foreign banks during the crisis. In order to formally test the "flight to quality" hypothesis, we distinguish groups of firms with opposing credit risk before 2010:Q4. In all tests we find that, to a greater extent than other bank groups, foreign banks intensified credit supply to low-risk firms to the detriment of high-risk firms.

Finally, we test whether foreign banks increased lending through the channel of internal capital markets. Unfortunately, we are not able to measure internal capital markets directly through banks' balance sheets. Similarly to what Berrospide, Black and Keeton (2013), and De Marco (2015) do, we use equity as a proxy for the use of internal capital markets. Results suggest that changes in equity have a sizeable effect on lending. We interpret our findings as evidence that the substitution effect for Brazil operated through the internal capital channel, even though equity is a relatively more costly source of finance (Myers and Majluf, 1984).

To our knowledge, this is the first paper in the literature that empirically tests the *substitution effect* of foreign banks on local lending by using a double negative shock. We use the rise of the sovereign crisis as an outside shock that affected foreign banks in their country of origin, and we use the Brazilian macro-prudential measures as a domestic shock that affected local lending. Our

findings suggest that international banks perceive investment opportunities and hence channel capital flows to more profitable markets. Even with the macro-prudential measures that aimed at curtailing credit supply in the country, Brazil continued presenting itself as a profitable market for international banks.

Our paper builds on a long literature that deals with the international transmission of liquidity shocks through the balance sheets of banks. Banks can transmit negative shocks to lending, both domestically (Kashyap and Stein, 2000; Jimenez *et al.*, 2012; Bofondi *et al*., 2013) as well as across borders (Peek and Rosengren, 2000; Cetorelli and Goldberg, 2011; De Haas and van Horen, 2012; Giannetti and Laeven, 2012; Popov and Udell, 2012; Schnabl, 2012; Popov and van Horen, 2013). According to Cetorelli and Goldberg (2011), emerging markets also experienced declines in lending from developed countries, with the greatest vulnerability to dollar-funding shocks in the period 2007-2009. Our paper documents findings that are opposite to the findings in this literature. During the rise of the sovereign crisis, with liquidity tensions in most developed countries, foreign banks substituted investments with lending in Brazil. Additionally, we document a "flight to quality" on the part of foreign banks during the crisis, where they focused lending on particular relationships and offered less support to fragile borrowers.

Additionally, we add to the recent literature that focus on bank-level characteristics that affect shock transmission. Bank ownership matters. Domestic and international banks behave differently in terms of the use of internal capital markets to manage liquidity, and in terms of lending in domestic markets (Cetorelli and Goldberg, 2012). Balance sheet strength also matters. Access to a stable funding base of domestic deposits and the strength of the foreign parent bank affect domestic lending. We add to this literature by documenting results that compare the lending behavior of foreign, private domestic, and public banks, controlling for time-varying balance sheet characteristics of the banks.

We also add to the literature that discusses the significance of the structure of host country markets for the transmission of shocks. After the crisis, foreign banks were more committed to geographically close countries hosting an affiliated subsidiary that had developed relationships with local banks (De Haas and van Horen, 2012). The shock transmission to the domestic market through the foreign parent bank is weaker for locations considered as important investment opportunities (Cetorelli and Goldberg 2012). We believe that our paper is unique in showing that

Brazil, although not geographically close to US nor to Europe, nor with developed interbank market connections, seems to have been an important market and a "safe haven" for foreign banks in 2010 and 2011.

Finally, related literature also focuses on the benefits of internal capital markets in bank financial conglomerates. Financial frictions leading to differences in external and domestic cost of funding, and the use of internal capital markets, are important pre-conditions for expecting to find in foreign banks a substitution effect on cross-market lending. Previous findings indicate that parent banks use internal capital markets to manage the credit growth of their foreign subsidiaries (De Haas and van Lelyveld 2010). Moreover, foreign banks use internal capital markets to reallocate resources among their subsidiaries, offsetting declines in domestic and international funding at liquidity-constrained subsidiaries (Campello, 2001; Ashcraft, 2006). Similarly to Berrospide, Black and Keeton (2013) and De Marco (2015), we use equity as a proxy for the use of internal capital markets. We find that changes in equity for foreign banks have a sizeable effect on lending. This leads to the conclusion that the substitution effect for lending in Brazil operated through the capital channel.

The rest of the paper is organized as follows. Section 2 describes the institutional details of Brazil and the macro-prudential measures. Section 3 presents the dataset and the main descriptive statistics. Section 4 discusses our empirical strategy and the model we propose to overcome these challenges. Section 5 contains the results of the baseline specifications, as well as a battery of robustness tests. Section 6 examines the extensive margin; section 7 formally tests the "flight to quality" hypothesis; and section 8 provides some evidence on the importance of the internal capital market channel for the transmission of cross-market foreign liquidity into lending. Finally, section 9 concludes with the main messages of the paper.

2 – Institutional details

2.1 – Before the Brazilian macro-prudential measures

Regardless of the global economic state, Brazil[4] sailed well through the first phase of the global financial crisis. In the second quarter of 2009, Brazil was already out of the recession[5]. In the year 2010, more than half of all the oil discoveries in the world was found in Brazil[6] and the country was already growing at a rate closer to that of India and China. Benefitting from temporary factors such as the difference between international and local interest rates, and excessive global liquidity[7], Brazil received large short-term foreign inflows[8]. Indeed, "global excessive liquidity is seen by many analysts as a major driving force behind recent capital flows into emerging markets in general, and Brazil in particular" (Silva and Harris, 2012).

Therefore, one of the main policy issues in Brazil in the second semester of 2010 was to manage the effects of large capital inflows. Brazil managed these foreign inflows with aggregate demand contraction through fiscal and monetary policies[9]. However, Brazil's credit market was being affected by multiple sources of foreign capital inflows (Silva and Harris, 2012), and a set of measures was consequently adopted, as discussed in the next section.

---

[4] Brazilian authorities took immediate action in 2008. Bank reserve requirements were lowered, injecting around $50 billion worth of liquidity (4% of GDP) into the banking system. Another $50 billion was provided for foreign exchange lines of credit in spot market auctions and swap contracts (22 % of total international reserves). The government calibrated other monetary and fiscal policy instruments to provide stimulus to economic activity and extended credit by public financial institutions with an additional $50 billion.

[5] BBC news published on September 11 2009, http://news.bbc.co.uk/go/pr/fr/-/2/hi/business/8251164.stm.

[6] Perry, Mark. "2010 Was A Very Good Year For New Oil Finds", published on January 8, 2011, http://www.dailymarkets.com/economy/2011/01/08/2010-was-a-very-good-year-for-new-oil-finds/

[7] Never in history, had government authorities needed to inject such amounts of liquidity into the banking system. The bailout of the U.S. financial system had budgets of up to $700 billion to purchase distressed assets and supply cash directly to banks. The response to the deterioration of European sovereign debt brought almost €500 billion. Governments of other major economies followed the same path of providing high doses of liquidity to banks in order to reduce the impact of the banking crisis on the real economy.

[8] During 2010, net capital inflows (defined as non-residents' net flow into portfolio investments, depositary receipts, direct investment, and external credits) amounted to US$125 billion, compared to close to US$80 billion in 2009. Brazil had a historically high amount of equity issuance, totaling R$146 billion, of which 26% were taken up by foreign investors. External debt issuance raised another US$ 48 billion, approximately. FDI net inflows amounted to US$ 38 billion (Silva and Harris, 2012).

[9] On the monetary policy front, between January and July 2011, the Central Bank took action and raised the policy rate by 175 bps in five consecutive monetary policy committee meetings. That followed the 200 bps increase of 2010 and totaled an overall rate hike of 375 bps. On the fiscal front, in February 2011, the Government reaffirmed its commitment to a strong fiscal stance with a steady reduction of the public debt to GDP ratio and proposed a fiscal consolidation of R$ 50 billion of expenditure cuts (Silva and Harris, 2012).

2.2 – The Brazilian macro-prudential measures

Excessive capital inflows contributed to the fast growth of domestic credit in Brazil. The diagnosis of Silva and Harris (2012) was that banks in Brazil were taking advantage of the ample liquidity in global markets to significantly increase their funding abroad, and then invest those resources in BRL-denominated domestic assets, including loans, thus capturing the interest rate differential. The concerns led the Central Bank of Brazil to implement the following macro-prudential measures[10]:

- Increased bank reserve requirements on deposits. In the beginning of December 2010, unremunerated reserve requirements were raised on term deposits from 15% to 20% (Circular 3513) and the additional remunerated reserve requirements on demand and term deposit were raised from 8% to 12% (Circular 3514). The new levels of reserve requirements worked as a countercyclical buffer set on deposits in order to smooth rapid credit growth.

- New reserve requirements on banks' short spot foreign exchange positions. In January 2011, the Central Bank imposed a 60% unremunerated reserve requirement on banks' short positions in the foreign exchange spot market exceeding either US$3 billion or Tier 1 capital, whichever was lower (Circular 3520). The new levels of reserve requirements on banks' short spot foreign exchange positions aimed at correcting imbalances in the foreign exchange market.

- Increased taxation of external credit inflows[11]. In March 2011, the authorities raised (from 5.38% to 6%) the IOF tax rate on inflows related to direct external borrowing and debt securities issued with a maturity below 360 days (before the average tenor was below 90 days) (Decree 7456). Higher taxes curtailed short-term speculative inflows, reducing the intensity and volatility of capital flows.

[10] Central Bank also increased capital requirements for consumer loans aiming at correcting a deterioration in the quality of loan origination. These measures focused essentially on loans for individuals and not for firms. Hence, this measure is not key for our study.

[11] In October 2010, the Tax on Financial Transactions (IOF) for nonresidents' portfolio investment in fixed income instruments was raised, first from 2% to 4%, and later in the same month to 6%. The IOF was also raised to 6% (from 0.38%) on incoming remittances destined to posting collateral on derivatives positions held at central counterparties for stocks, commodities or futures trading. The IOF rate increases were expected to curb excessive short-term and speculative capital inflows and lengthen flow composition, in particular by discouraging short term carry trades in both spot and futures markets.

While the macro-prudential measures decreased the incentives for banks to tunnel resources for lending through the bank's balance sheet, the measures maintained incentives for banks to use the capital channel. Equity remained as an open channel for lending in Brazil, with the same 2% IOF tax rate. Because equity is a relatively costly source of finance (Myers and Majluf, 1984), we expect that the macro-prudential measures have given foreign banks greater incentives to substitute to Brazil compared to domestic banks, although foreign banks were being adversely affected with the rise of the sovereign crisis.

Figure 1 summarizes the periods before and after the Brazilian macro-prudential measures, with the shocks, channels and effects we expect to find.

– Insert Figure 1 here –

3 – Data and descriptive statistics

In this paper, we use a rich dataset from the Central Bank of Brazil that contains specific information on bank–firm credit relationships. The credit register lists all outstanding loan amounts above a threshold of 5,000 Brazilian Real[12] that each borrower has with banks operating in Brazil, including foreign banks. Data is required at a monthly frequency, and intermediaries use the credit registry as a screening and monitoring device for borrowers. It is also used by Central Bank to monitor and supervise the banking sector. Central Bank ensures the quality of the data and our dependent variable is considered to be of high quality, since total outstanding loan amount at the credit registry must match the accounting figures for credit loan.

The samples we use from the credit registry include all non-financial and private firms with outstanding credit. We also obtained from Central Bank consolidated and unconsolidated balance sheet data with quarterly frequency from all the banks operating in Brazil. In addition, we have bank ownership and conglomerate information. After several examinations to ensure that the data is of high quality, we merge these different datasets using the public bank identification number.

[12] Around 2,500 USD in December 2012.

The sample of banks includes commercial banks and universal banks with a commercial portfolio[13]. Furthermore, banks should appear in the pre- and in the post-period.

For the purpose of our analysis, we focus on information around the Brazilian macro-prudential measures of the third quarter of 2010. These measures represent a negative shock to the growing Brazilian credit market. If the substitution effect is truly happening, we expect that foreign banks will be less respondent to the law change in comparison with private domestic banks. We select a sample period that runs from 2009:Q4 until 2011:Q3. The start of the period has the advantage that it excludes the unprecedented collapse in syndicated lending during the global financial crisis. Thus, it reduces the risk that the results are influenced by other events or developments occurring in the previous period. We chose 2011:Q3 as the end of the sample period in order not to have our main results contaminated by the ECB's exceptional long-term refinancing operation introduced in December 2011[14]. The quarter in which we split the sample is 2010:Q4.

Therefore, we have four quarters before the exogenous event and four quarters after it. Choosing this specification instead of using five quarters before and after also alleviates concerns about lending seasonality (lending is stronger before Christmas, but weaker before Carnival). As a robustness check, we do the exercise using the period from 2009:Q2 to 2011:Q4, however results are quantitatively unchanged. The same applies when we test for the possibility that 2011:Q1 is the correct start of the post-period.

We exclude default operations with more than 90 days, reducing the risk that results are influenced by the carry amount of non-paid debt in the dependent variable. Results are robust to the inclusion of default loans[15]. We keep firm–bank relationship if it appears in the pre-period for at least three out of the four possible quarters. The same applies for the post-period. Therefore, we keep the bank–firm relationship if there is a 75% minimum appearance throughout the sample period. This partially controls for mergers and acquisitions among banks. Results are also robust to the loosening of such restriction. We further control for M&A and rebalancing of the bank's

[13] The Brazilian Development Bank (BNDES) is excluded from the sample given its particular objectives and operational differences, especially on its cost of funding and its long-term assets.

[14] On December 8, the Governing Council of the European Central Bank (ECB) decided on additional enhanced credit support measures to bank lending and liquidity in the euro area money market. Long Term Financing Operations (LTRO) summing almost €500 billion temporarily eased tensions in funding markets.

[15] In the case that a firm is in default for more than 90 days and continues in this situation, the outstanding loan amount stays the same throughout the sample period. By excluding these operations, we are able to follow the actual change in credit supply of banks in the post-period.

loan portfolio, by tracking whether each loan was initiated by the bank itself, or whether it is a new relationship with the acquirer bank. Results are robust to the exclusion of such loans.

In the *full sample*, we track 963,299 firms and 98 banks that together result in 1,303,570 bank–firm pairs. The data level is a triplet on the firm–bank–time dimensions. The dependent variable is *Lending*, defined as the natural logarithm of total outstanding loan amount of borrower *i* at bank *b* in quarter *t*. In order to limit extreme values in the statistical data and reduce the effect of possibly spurious outliers, we winsorize *Lending* on 98%/2% level. Results are robust when *Lending* is only winsorized in the pre-period. Results are also robust to the loose of this restriction.

Table 1 shows the definitions of *Lending* and of all other variables used in our paper.

– Insert Table 1 here –

We use dummy variables to indicate the bank's ownership. *Foreign* takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise. *European banks* take the value one if ownership control of bank in Brazil is from a European country (with the exception of UK and Switzerland), and zero otherwise. *GIIPS banks* take the value one if ownership control of bank in Brazil is from a GIIPS country (Greece, Italy, Ireland, Portugal and Spain), and zero otherwise. Last, *Government* takes the value one if bank is public, and zero otherwise. Additionally, we have several bank-level characteristics, which include the size of the bank, the ratio of liquid assets, deposits and equity to total assets, return over assets, international funding, the cost of funding and the size of impaired loans. These controls enable one to check the robustness of our findings, in particular whether the inclusion of other covariates changes the impact estimated in the baseline models.

Table 2 – Panel A shows summary statistics of the variables from the *full sample*.

– Insert Table 2 here –

The median loan amount is approximately 30,000 USD. Foreign banks correspond to 11% of the observations on bank–firm relationships. From these firm–foreign bank relationships, around 65% are with European banks, of which almost all relationships are from the GIIPS countries. Government banks correspond to 39% and private domestic banks to 49% of the firm–bank–time observations. Banks use on average 82% of their own resources to fund borrowers, while most of the other 18% comes from government sources, such as federal programs aimed at specific regions (*e.g.*, to the North and Northeast region in Brazil) and certain types of activities (*e.g.*, to the agri-business liquidity and investment needs).

It is important to mention two points. On one hand, overall *Lending* increased even after the Brazilian macro-prudential measures. *Lending* in log amount using domestic currency was 11.05 before the change in the law and it increased to 11.07 after that (0.02 in the "Diff." column of Table 2). This is a statistically significant change, as we can observe from the *p-value* of the T-Test column. On the other hand, one can notice that the risk of foreign banks, measured by the quarterly average Credit Default Swap (5 years bond), increased substantially (from 0.12 in the "Before" column to 0.18 in the "Diff." column). The increase in foreign banks' CDS spread is statistically significant and is interpreted as a decline in foreign economic conditions by the end of 2010 onwards.

In order to control for firm unobservable heterogeneity, we select only firms borrowing from at least two banks from the f*ull sample*. Since the identification strategy relies on a comparison between the behavior of foreign banks and other banks (private domestic and government owned) at the same time, we select firms that borrow from at least one foreign bank and from one other bank (private domestic or government owned) in the pre- and in the post-period. This is our r*estricted sample*.

The strategy of using our *restricted sample* permits a powerful identification within borrowers in order to disentangle credit supply from credit demand. Specifically, we investigate the impact on the intensive margin on the same firm at the same point in time for foreign banks and for non-foreign banks. In the analyses, we track 79,906 bank–firm pairs with foreign banks, 51,033 with government banks, and 80,258 with private domestic banks. There are 74,117 firms in the sample. The data level is a triplet on the firm–bank–time dimensions.

Table 2 – Panel B shows summary statistics of all variables from the *restricted sample*. The median loan amount is approximately 85,000 USD. As in the full sample, *Lending* in the *restricted sample* increased in the post-period compared with the pre-period. It was 12.12 in log amount before the change in the law and it increased to 12.18 afterwards (0.06 in the "Diff." column of Table 2). This is an economic and statistically significant change, as we can observe from the p-value of the T-Test column. Moreover, 38% of the firm–bank–time observations are with foreign banks, 24% with government banks, and 38% with private domestic banks. Banks use on average 86% of their own resources to fund borrowers.

The median bank in the sample has a size of approximately 200 USD million, with a balance sheet structure of 37% of their total assets invested in liquid assets. The median bank has 47% of their obligations as deposits, 7% as equity and a small involvement of international sources of funding, around 1%. Even with the reasonable level of impaired loans and the high costs of funding compared to other economies, the median bank has a net positive income. However, there is extreme variance in the cross-section dimension of bank's balance sheet structure and size. Such balance sheet differences can be correlated with credit supply, so we formally include these variables in the regressions analyses. It is important to cite that systematic differences across banks are controlled in the regressions by bank fixed effects.

Table 3 shows the means of the variables for the group of foreign, private domestic, and public banks with their respective t-tests comparing the mean before and after the Brazilian macro-prudential measures. The differences in means of *Lending* from foreign banks increased from 11.53 to 11.59. The differences in means of *Lending* from government banks also increased (from 11.08 to 11.13), whereas for private domestic banks it decreased (from 10.92 to 10.89). All changes are statistically significant, as we can observe from the p-value of the T-Test column.

– Insert Table 3 here –

The differences in means of *Lending* from foreign banks compared with government or with private domestic banks are statistically significant. Moreover, foreign banks in Brazil are smaller than other banks, have more liquid assets than private domestic banks, receive less deposits, are

less leveraged, make less profit than private domestic banks, have more access to international funding, with funding being more costly than government banks, and have a lower level of impaired loans. The difference in the means of balance sheet variables among foreign, private domestic, and government banks is also statistically significant. Once again, there is a need to include them as variables in the regressions analyses.

We recognize that it is possible that the *restricted sample* is not representative of the population of firms in Brazil. As we do not know the public identity of the firm, their location, nor their industry, it is difficult for us to give an account of the importance and the direction of the selection bias. We test for the significance of the difference of coefficients of *Lending* between the full and the restricted sample, both in Table 2 and in Table 3. We find that the coefficients are statistically significant. Hence, as we select firms with multiple banking relationships, these firms are expected to be larger firms. To the extent that medium and large firms represent most of the Brazilian GDP, and that the non-exclusivity in banking relationship is most controversial in the literature, the selection bias may actually be beneficial for our analysis. These are the situations where the firm may have a better chance of accessing credit (if not from one bank, from another one), and this is exactly what we want to capture in terms of credit supply.

Appendix Table 1 provides a list of all the foreign investors that own and control banks in Brazil and that are present in our sample[16]. Additionally, we present their country and their average total assets for the pre- and the post-period[17]. In total, we have 27 foreign investors. The majority of institutions are owned by American parent banks and institutions, although the biggest player is Santander from Spain, followed by HSBC from UK. Banks that increased their size to a greater extent during the sample period were Deutsche Bank with 61% increase in total assets, followed by Portuguese Caixa Geral de Depositos with 57%, and American Cargil, with 33%. On the other

[16] Using information from December 2010, we find that six foreign investors had involvement in Brazil through branches only. A foreign branch provides investors with a structure that has more highly centralized decision making and a lower restriction in terms of intra-group transfers (Fiechter *et al.*, 2011).

[17] With the exception of the Swiss BP Empreendimentos (authorized to invest in the Bank Bracce in 2007), all other foreign investors have been present in Brazil at least since 2002.

hand, German Commerzbank[18] decreased its size by 28%, followed by ING[19] with a 27% lower figures, and Credit Suisse[20] decreasing by 20%. Foreign banks increased their size by 13% in one year, even though, by the end of 2010 the participation of foreign banks was still small compared to neighboring countries, with 17% participation in the overall Brazilian market (IMF, 2012).

– Insert Appendix Table 1 here –

4 – Empirical strategy

4.1 – Empirical issues

The goal of this paper is to identify whether and how foreign banks substitute their investments during liquidity tensions in their country of origin to *Lending* in Brazil. However, identifying the substitution effect of foreign banks on credit supply poses important challenges.

First, the flood of money that Brazil was receiving in 2010 came through private domestic, government, and foreign banks. Banks had at least three channels on the liability side of their balance sheets through which to increase credit supply in the country: domestic funding (*e.g.*, local deposits and interbank deposits), international funding (*e.g.,* international interbank deposits, bonds issued abroad), and equity increases (*e.g.*, new shares)[21]. All banks were increasing *Lending* in a similar trend until the third quarter in Brazil, as we can see in Figure 2.

[18] After the collapse of Lehman Brothers, Commerzbank faced difficulties and had to be bailed out by the German government with a cash injection of €18.2 billion. On September 2010, the Bank of Nova Scotia, the biggest Canadian bank, agreed to the purchase of Dresdner Bank Brasil SA from its parent, Commerzbank AG.

[19] ING also faced difficulties in the end of 2008 and received capital injection of €10 billion from the Dutch Government. The help came in the exchange for securities and veto rights on major operational and investment decisions of the bank. As a condition of approving the state aid, the European Commission also required the bank to sell its insurance and investment management operations.

[20] Following the crisis, Credit Suisse had to cut more than €1 trillion in assets internationally. In Brazil, investigations took place in 2008 and 2009 regarding the use of Credit Suisse accounts for tax evasion. The investigation led to arrests that year and in 2009, and were part of a larger crackdown in Brazil on illegal money transfers over the years, probing international banks about whether they helped Brazilians to evade taxes.

[21] In the pre-period, government banks had a higher deposit ratio (0.49) compared with other banks (0.37 for both foreign and government banks). Government banks also had a higher international funding ratio (0.03) compared with other banks (0.01 and 0.02 for foreign and private domestic banks, respectively). Foreign banks had a much higher equity ratio (0.14) compared with government banks (0.06) and private domestic banks (0.10).

– Insert Figure 2 here –

Because the *Lending* dynamics of foreign and domestic banks were in similar trends before the fourth quarter of 2010, it was a challenge to capture the substitution effect of foreign banks in the pre-period (2009:Q4 to 2010:Q3). We also plot *Lending* for the three groups of banks using our *restricted sample* in Figure 3. As one can note, we continue observing a similar trend among these groups of banks in the pre-period.

– Insert Figure 3 here –

With the Brazilian macro-prudential measures at the end of 2010, the government decreased bank incentives for banks to channel deposits or international funding to into lending. However, banks could still operate in the credit supply market through the capital channel. We expect foreign banks to be particularly incentivized to use this channel, given the higher bonds between the foreign parent bank and its local subsidiaries. Hence, equity is a natural proxy for the use of internal capital markets[22]. If it is true that foreign banks indeed had higher incentives to substitute to Brazil, we should be able to capture the substitution effect on lending more clearly after the Brazilian macro-prudential measures. Hence, we use 2010:Q4 to separate the pre-period from the post-period.

Another challenge is to identify banks, otherwise comparable, that have been differently affected by the rise of the sovereign crisis in Europe. Since private domestic and government owned banks are within Brazil, with limited foreign exposures, we consider foreign banks as the treatment group, or in other words, the group we aim to further investigate. Furthermore, we consider European banks and particularly banks from the GIIPS countries to be the banks most exposed to the sovereign crisis.

Third, the Brazilian GDP should be exogenous with respect to the conditions of foreign banks. Foreign banks are already present in Brazil, so this is not the case. However, foreign banks

[22] This is similar to what Berrospide, Black and Keeton (2013), and De Marco (2015) do.

have a lesser involvement in the Brazilian Financial System than peer countries. Moreover, when compared with domestic banks, foreign banks did not increase their involvement in lending after the September 2008 collapse of Lehman Brothers and before the end of 2009. Since foreign banks cannot be considered as fully insulated by the growth of the Brazilian economy, the effect we identify in the paper should be interpreted as an upper bound to the full causal impact of the surge of the Brazilian growth in lending.

A fourth issue is to properly control for firm-level demand for credit. The dataset allows us to do so. The methodology for estimating the credit supply channel focuses on firms borrowing from multiple lenders, where the banks differ in their exposure to the rise of the sovereign crisis. Thus, our methodology relies on the assumption that the subsample of firms trading with multiple banks is random and that demand for credit on the firms' side remain constant during the crisis. In fact, using firm fixed effects, we compare how the same firm's outstanding loan amount - *Lending* - from a foreign bank changes relative to another bank (private domestic or government owned). The within-firm comparison fully absorbs firm-specific changes in credit demand, enabling us to argue that the estimated difference in *Lending* for foreign banks can be attributed to the substitution or spillover effect.

We go one step further by including firm–time fixed effects in the regressions, similar to what is done by Khwaja and Mian (2008), Jimenez *et al.* (2012), Bofondi *et al.* (2013), and Popov and Van Horen (2013). The firm–time fixed effects enable us to control for all firm-level unobserved heterogeneity that affects the dynamics of credit granted in each period, making the comparison of foreign banks with other banks even stricter.

In principle, foreign, private domestic, and government banks may be different on several dimensions, and comparing them to assess the effect of the rise of the sovereign crisis in Europe and the Brazilian macro-prudential measures on credit supply may not warrant identification of the substitution or the spillover effect. Our identification strategy based on comparing lending by different banks to the same firm, allows us to fully control for possible differences in the composition of borrowers across different types of banks. Moreover, we include bank fixed effects in the regressions, so that we can control for all unobserved time-invariant heterogeneity among lenders, including differences in the composition of loan portfolios, lending policies, managerial risk appetite, etc.

Furthermore, we include bank-level characteristics in the regressions where we also apply firm–time and bank fixed effects, similarly to Bofondi *et al.* (2013), and Popov and Van Horen (2013). These variables include the size of the bank, the ratio of liquid assets, deposits and equity to total assets, return over assets, international funding, the cost of funding, and the size of impaired loans. These bank-level variables enable one to check the robustness of the findings, in particular whether the inclusion of other covariates changes the impact estimated in the baseline model.

Table 4 is the one that best captures the main identification strategies. We collapse the data into a single data point (based on averages) both before and after the reform. This results in two data points per unit of observation, one data point for the pre-reform regime and one point for the post-reform regime. This time-collapsing of the data ensures that the standard errors are robust to Bertrand, Duflo and Mullainathan (2004) critique[23].

– Insert Table 4 here –

In Panel A, we report the before–after results of the variable *Lending* for groups of banks using the *full sample*. As can be seen, *Lending* increased six percentage points after the reform (0.0638 in the Difference column) for foreign banks, whereas government banks increased 0.045 and private domestic decreased 0.0242. *Lending* for firms with multiple banking relationships increased more after the reform for foreign banks, with plus six percentage points, in comparison with domestic banks (0.0574 in the Difference column for "Difference (Foreign–Domestic)"). In Panel B, we use information from our *restricted sample*. Results for the "Difference (Foreign–Domestic)" is similar to the one from the full *sample*. In Panel C, we report the before–after results of the variable *Lending* for European banks. It is interesting to note the difference in *Lending* from European banks and all other banks (other foreign, government and private domestic), which is still high, around five percentage points.

[23] Bertrand, Duflo and Mullainathan (2004) critique relates to serial correlation - the tendency for one observation to be correlated with those that have gone before – especially in differences-in-differences models. The simplest and most widely applied approach is simply to time-collapse the data. We believe that our number of bank clusters does not cause biased standard errors or misleading estimates.

Because of computational limitations, we run the regressions using our *restricted sample* only.

4.2 – The model

We use credit registry data on firm–bank–quarter level. We use the following specification to investigate whether foreign banks differ with respect to the lending volume in the post-period compared with other banks. We start with a specification with firm, bank, and time fixed effects.

$$Lending_{i,b,t} = \alpha_i + \alpha_b + \alpha_t + \beta_1 Foreign_b * Post_t + \varepsilon_{i,b,t} \quad (1)$$

where $Lending_{i,b,t}$ equals the log of outstanding loan amount of borrower *i* at bank *b* in quarter *t*, winsorized on 98%/2% level. $Foreign_b$ is a dummy variable that takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3, and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. We also include a full set of firm, bank, and time fixed effects, respectively α_i, α_b and α_t, controlling for unobserved heterogeneity at each of the triplet dimensions. $\varepsilon_{i,b,t}$ is an idiosyncratic error term. Since the residuals may be correlated across banks and across time (Bertrand, Duflo and Mullainathan, 2004), we cluster standard errors at the bank level.

The main challenge is the simultaneous nature of the bank lending channel (credit supply) and the firm borrowing channel (credit demand). We completely capture any demand shocks at the firm level by using firm–time fixed effects controls $\alpha_{i,t}$. This comes at the cost that one needs to restrict our analysis to those firms with multiple bank relationships at the same time. In our case, we restrict the firm to having a relationship with one foreign and with one other bank (private domestic or public) in the pre and in the post-period. Our most conservative specification is:

$$Lending_{i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \gamma_1 X_{b,t} + \varepsilon_{i,b,t} \quad (2)$$

where vector $X_{b,t}$ controls for a set of observable characteristics of bank *b* at time *t*, including the size of the bank, ratio of liquid assets, deposits and equity to total assets, return over assets, international funding, cost of funding, and size of impaired loans. Therefore, we are able to control for further bank-specific determinants of credit supply not captured by the bank fixed effects α_b. In order to check whether the inclusion of other bank covariates changes the impact estimated in the baseline model, we also show estimates of equation (2) without vector $X_{b,t}$.

As we know that government banks had a countercyclical behavior during the financial crisis (Coleman and Feler, 2014), we also estimate our equations incorporating their differential impact. One example is equation (2), which is then estimated in the following manner:

$$Lending_{i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \gamma_1 X_{b,t} + \varepsilon_{i,b,t} \quad (3)$$

where $Government_b$ is a dummy variable that takes the value one if bank is public, and zero otherwise. Therefore, the comparison becomes the change in lending, from the pre- to the post-period, for foreign banks relative to the control group, private domestic banks in the case above.

In the previous cases, our coefficient of interest is β_1. Using a difference-in-differences approach, β_1 captures the change in lending, from the pre-treatment to the post-treatment period, for the treatment group (foreign banks) relative to the control group (private domestic and government banks in equation (1) and (2) and private domestic banks in equation (3)). A positive coefficient β_1 would imply that all else being equal, lending increased more (decreased less) for the group of foreign banks. The numerical estimate of β_1 captures the difference on the change in lending between the pre- and the post-period induced by switching from the control group to the treatment group.

Foreign banks operating in Brazil are very heterogeneous in terms of their countries of origin and their risk levels. Since we analyze the substitution effect in the rise of the sovereign crisis, we want to select banks that are more affected abroad. To this end, we focus the analysis on a specific group within *Foreign*. For this end, we estimate the following:

$$Lending_{i,b,t} = \alpha_{i,t} + \alpha_b + \delta_1 European_b * Post_t + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \gamma_1 X_{b,t} + \varepsilon_{i,b,t} \quad (4)$$

European is a dummy variable that takes the value one if the ownership control of the bank in Brazil is from a European country (with the exception of UK and Switzerland), and zero otherwise. We also interchange *European* for *GIIPS banks*, which is a dummy variable that takes the value one if ownership control of bank in Brazil is from a GIIPS country (Greece, Italy, Ireland, Portugal and Spain), and zero otherwise. Moreover, we use the quarterly average Credit Default Swap (CDS spread of 5 years contract). This is as a continuous exposure variable of foreign banks to the crisis. In specification (4), our coefficient of interest is δ_1. In a difference-in-differences approach, δ_1 captures the change in lending, from the pre-treatment to the post-treatment period, for the treatment group (European banks, GIIPS banks, or foreign banks*CDS spread) relative to the control group (private domestic banks).

A key assumption underlying the validity of the identification strategy is that *Lending* from foreign banks and other banks has a similar trend in the pre-period, conditional on all controls. Because all the regressions include bank fixed effects, we are already controlling for bank-specific time-invariant differences. Therefore, the requirement for a common trend then only applies to how much foreign banks, private domestic banks, and government banks depart from their time-invariant component in the pre- to the post-period.

We conduct two tests to address this issue. In the first one, we test the credit supply of foreign banks relative to private domestic banks, after tensions in the European interbank market in August 2007[24]. We observe that the initial crisis that hit Europe had on average an economically and statistically insignificant impact on credit supply from foreign banks operating in Brazil. It is true, however, that there could be a lagged effect of the European interbank market tensions on credit supply in Brazil. In this case, this lagged effect would be picked up by our next exercise, where

[24] We choose this setting, following Iyer *et al*. (2014), who argue that the crisis in Europe started with the interbank loan spreads going significantly up, pushing the European Central Bank to inject large amounts of liquidity. On August 9 2007, the ECB injected €95 billion in order to provide sufficient liquidity to banks, and on the following week, the ECB injected an additional €150 billion (ECB Financial Stability Review, 2009).

we test the credit supply of foreign banks relative to private domestic banks, after the collapse of Lehman Brothers in September 2008. We observe that the impact of the collapse of Lehman Brothers had a negative but not statistically significant impact on *Lending* for foreign banks compared with private domestic banks. This is an indication that the effect of the financial crisis of 2008 was asymmetric for foreign banks. Nonetheless, results point to the validity of the main findings of the paper.

5 – Empirical evidence

5.1 – Baseline model

Table 5 provides the first results of the paper. We regress *Lending* on foreign bank ownership in the post-period in a differences-in-differences approach. Columns (1) to (3) show the effect of the dummy foreign on the amount of credit supplied in the period from 2010:Q4 to 2011:Q3. In column (1), we include bank, firm, and time fixed effects, but do not control for time-varying bank characteristics. The estimate of coefficient β_1 is not statistically significant, although positive and economically meaningful, suggesting that foreign banks did not decrease lending more than other banks operating in the country. In order to address the possibility that there are time-varying differences in borrower demand and/or quality, in column (2) we include firm–time fixed effects. In this setting, results become statistically significant[25]. Results are robust when we also control for time-varying bank characteristics, as one can observe in column (3).

– Insert Table 5 here –

Brazilian government banks displayed countercyclical behavior during the global financial crisis (IMF, 2012). They provided more credit, offsetting declines in lending by private banks (Coleman and Feler, 2014). With this argument, we regress *Lending* on foreign and government bank ownership in the post-period. In equations (4) to (6), the interest is on foreign banks versus

[25] We take this as evidence that there is considerable time-series variance within firm–bank outstanding debt (*e.g.*, new loans appearing and old loans disappearing from the credit registry). This variance is mitigated by the use of firm–time fixed effects.

private domestic banks in 2010:Q4 and after. In column (4), one can observe the increase in economic significance of foreign ownership on *Lending*, when compared to the results in column (1). Column (6) in Table 5 presents the preferred estimation providing an unbiased estimate of the bank-lending channel. *Ceteris paribus*, foreign banks increased six percentage points of the outstanding loan amount, compared with private domestic banks. Because specification (6) include a set of fixed effects and time-varying bank controls, it is unlikely that the results are driven by unobservable time-varying differences in borrower demand and quality, nor by time-invariant bank heterogeneity, nor by time-varying differences in the bank's structure, behavior, or risk appetite.

5.2 – Exposure measures

We address the heterogeneity issue in relation to the markets where the parent banks in our sample are domiciled. Here, we test whether different groups of foreign banks, namely *European banks*, and banks from *GIIPS* countries (Greece, Italy, Ireland, Portugal and Spain) behaved differently during the baseline sample period. Table 6 reports the core results of the paper.

– Insert Table 6 here –

In column (1) to (3), we use a dummy variable to define *European banks* (except for banks from UK and from Switzerland). Our argument is that the sovereign crisis increased the incentives for banks domiciled in the Euro area to divest domestically and invest abroad[26]. The estimates from column (1) and (2) imply that *European banks* did not increase *Lending* in Brazil any more than other foreign banks. However, results change completely when we include time-varying bank characteristics, as one can observe in column (3). In this case, *European banks* increased *Lending* by nine percentage points above private domestic banks in the post-period. Results are also

[26] It is important to take into account the "fragmentation event" that occurred after the crisis, mainly within the European banking industry. Although foreign banks channeled resources into Brazilian assets, including sovereign securities, to earn currency risk-free arbitrage profit (carry trade), there was a structural limitation. In order to strengthen their capital, some European banks had to diminish their exposures abroad in order to better comply with Basel requirements on a consolidated basis.

statistically different from the estimates of other foreign banks. We interpret these results as evidence for spillover effects on European banks. By formally controlling for the negative balance-sheet externalities, we continue finding strong evidence for the substitution effect.

We go a step further. In column (4) to (6), we consider banks from GIIPS countries. This is relevant since the market share of Spanish and Portuguese banks is the highest among foreign banks in Brazil. The estimates from column (4) and (5) imply that *GIIPS banks* did not increase *Lending* in Brazil to any greater extent than other foreign banks. Once again, results change completely when we include time-varying bank characteristics, as one can observe in column (6). *GIIPS banks* increased *Lending* by nine percentage points above other foreign banks in the post-period. Thus, by formally controlling for the negative balance-sheet externalities of *GIIPS banks*, we continue to find strong evidence for the substitution effect.

One disadvantage of using groups of foreign banks is that it does not allow us to calculate the effect of a marginal increase in sovereign debt exposure on lending at the bank level. Therefore, we report estimates from a regression where the binary variable for group of foreign banks has been replaced with a continuous variable. In column (7) to (9), we use the quarterly average Credit Default Swap (CDS spread of five years contract) as a continuous exposure variable of foreign banks to the crisis. Private domestic and government banks are defined as having CDS equal to zero throughout the sample period. The estimates from column (7) and (8) shows a weak evidence that higher CDS spreads are associated with higher credit supply. Results change completely when we include time-varying bank characteristics, as one can observe in column (9). Higher levels of *CDS spread* are interconnected with an increase in the bank–firm lending relationship. This shows that a marginal increase in the exposure of a foreign bank leads to an intensified substitution effect on *Lending*.

5.3 – Robustness

There are several possible concerns regarding the estimates. We consider a number of robustness tests and alternative explanations that may fully or partially account for the results reported in Table 5 and 6.

5.3.1 – Other sample periods

Our findings document Brazil as a substitute market for foreign banks for the period of 2010-2011. However, our argument would be weakened if foreign banks and other banks did not show a similar trend in the pre-period, conditional on all controls. Because all the regressions include bank fixed effects, we are already controlling for bank-specific time-invariant characteristics. Therefore, the requirement for a common trend only applies to how much foreign banks, private domestic banks and government banks depart from their time-invariant component in the pre- and post-period.

We conduct two tests with previous sample periods to better understand the credit supply of foreign banks in the country. Estimates are found in Table 7. In column (1) to (3), the sample period goes from 2006:Q3 to 2008:Q2, where *Post* is a dummy variable that takes the value one starting from 2007:Q3, after tensions in the European interbank market in August 2007. We choose this setting, following Iyer *et al*. (2014), who argue that the crisis in Europe started with the interbank loan spreads going significantly up, pushing the European Central Bank to inject large amounts of liquidity[27]. Throughout columns (1) to (3), one can observe that the initial crisis that hit Europe had on average an economically and statistically insignificant impact for credit supply of foreign banks operating in Brazil.

– Insert Table 7 here –

In columns (4) to (6), the sample period goes from 2007:Q3 to 2009:Q2, where *Post* is a dummy variable that takes the value one, starting from 2008:Q3, after the collapse of Lehman Brothers in September 2008. Throughout columns (4) to (6), one can observe that the impact of the collapse of Lehman Brothers had a negative but not statistically significant impact on *Lending* for foreign banks compared with private domestic banks. Results are robust to applying the set of

[27] On August 9 2007, the ECB injected €95 billion in order to provide sufficient liquidity to banks, and on the following week the ECB injected an additional €150 billion (ECB Financial Stability Review, 2009)

fixed effects and time-varying bank characteristics. This may be an indication that the effect of the financial crisis of 2008 was asymmetric for foreign banks. Nonetheless, results point to the validity of the main findings of the paper.

Additionally, we also address concerns about the sample period selection and the criterion used to split sample periods. Concerning the sample period selection, one argument could be that the sample period of four quarters in the pre-period and other four quarter in the post-period is not wide enough. We extend the sample period from 2009:Q3 to 2011:Q4, instead of 2009:Q4 to 2011:Q3. *Post* continues as a dummy variable taking the value one starting from 2010:Q4. The results suggest that a bigger sample also captures the foreign bank behavior regarding *Lending* in the post-period.

Concerning the criterion used to split sample periods, we also test our equations for the sample period from 2010:Q1 to 2011:Q4, instead of 2009:Q4 to 2011:Q3. *Post* is a dummy variable that takes the value one starting from 2011:Q1, instead of 2010:Q4. In this manner, the test is closer to the outburst of the sovereign crisis in Europe. Results are robust to the raising of sovereign debt concerns in the old continent.

5.3.2 – Alternative explanations

Results may be driven by direct resources coming from government to attend certain regions of the country or specific sectors of the economy. Examples of resources to attend certain regions of the country include constitutional funds for the financing of the North, Northeast, and Central-West regions of Brazil. In a broader perspective, there are also resources coming from the Brazilian Development Bank–BNDES–to help firms in investment projects, assist in acquisition of new machinery and equipment, export of machinery, acquisition of goods and production inputs, in addition to special financing programs focused on specific economic segments[28].

We address this issue by re-running the main specification, this time controlling for the origin of the money. To that end, we construct a new variable, *Other resources*, which is a ratio of the debt of borrower *i* at bank *b* in quarter *t* issued with resources others than the bank's one to the

[28] These resources are transferred to foreign, private domestic, and government banks that participate and share the credit risk of borrowers with the Brazilian government.

total quarterly debt of the borrower with the bank[29]. In order to properly control for the importance of *Other resources* in the regressions, we interact *Other resources* to three other variables, namely to *Post*, to *Foreign * Post* and to *Government *Post*.

We expect that the estimate for *Foreign * Post* continues positive and with economic and statistical significance. This would suggest that the substitution effect is indeed in play. Results are reported in Table 8, columns (1) to (3). Evidence strongly suggests that the results of *Foreign * Post* are not contaminated by direct resources from the government.

– Insert Table 8 here –

Furthermore, the coefficient for *Foreign * Other resources * Post*, if negative, indicates the presence of another type of substitution effect. We explain this substitution effect as follows: the more foreign banks rely on direct resources from the government, the lower is the credit supply from their own resource to the specific set of firms we consider. This 'frees up' resources at the bank to provide credit to borrowers that did not rely, or relied less on loans with O*ther resources*. Indeed, the estimates of this triple interaction term is negative and statistically significant. Our interpretation of these findings is that the positive impact of foreign banks on credit supply is mitigated if the bank uses more direct resources from the government.

At first glance, evidence suggests that *Lending* was organically increasing to a greater extent in foreign banks compared with private domestic banks. In order to search for further evidence in this direction, we take into account the possibility that results may be driven by portfolio re-allocations, including the partial or full divestment of credit portfolios by smaller and weaker banks to bigger and stronger institutions[30]. To that end, we construct a new variable, *Loan acquisition*, which is a ratio of the amount of debt of borrower *i* at bank *b* in quarter *t* acquired but not initiated by the bank itself to the total quarterly debt of the borrower with the bank. Therefore, we are able

[29] Conceptually, we are looking at the share of debt of borrower *i* with bank *b* that is funded with other resources. However, we acknowledge the importance to further control for the total share of 'other resources' loans at the bank level. We believe that by using the several bank controls that we do, we are indirectly controlling for how much use a bank makes of other resources from the government.

[30] These transactions do not include securitization of credit operations.

to control for mergers and acquisitions among banks, including rebalancing of a bank's loan portfolio.

We explicitly control for the importance of *Loan acquisition* in the regressions by interacting *Loan acquisition* with three variables, namely to *Post*, to *Foreign * Post* and to *Government *Post*. We expect that the estimate for *Foreign * Post* continues positive and with economic and statistical significance. Results are reported in columns (4) to (6), suggesting that the substitution effect is indeed in play. In addition, we consider the coefficient for *Foreign * Loan acquisition * Post*, if positive, as an indication that the impact of foreign banks on credit supply is intensified for firms that had loans acquired by these banks. The estimates of this triple interaction term is positive and statistically significant, as reported in columns (4) to (6). Credit supply in the post-period is larger for foreign banks, and even larger for borrowers for which a larger share of the bank–firm relationship is acquired (not initiated by the bank).

Another possible concern regarding the results is that foreign banks may have increased *Lending* because the relationship with their customers was weaker in the pre-period (De Haas and Van Horen, 2013). Moreover, there might be a borrower-induced choice of multiple lenders (*i.e.*, borrowers who borrow from a historically weak bank try to compensate with a stronger one). In order to reduce these possibilities, we keep firm–bank relationship if it appears in the pre-period for at least three out of the four possible quarters. The same applies for the post-period. Therefore, regressions include bank–firm relationship if there is a 75% minimum appearance throughout the sample period.

However, in order to test it in a stricter sense, we account for firms with three or more bank relationships, where the firm must have a relationship with one foreign, with a private domestic bank and with a public bank in the pre- and in the post-period. Even in such a setting, column (7) to (9), the results continue to hold, suggesting that the main finding is not driven by the possibility of borrower-induced choice of multiple lenders.

There are other alternative explanations that one could come up with. These include concerns related to potential systematic differences across groups of banks in the currency denomination of the loans (Van Horen and Popov, 2014). This is not a concern in our case, as all loans in Brazil, including those related to importation and exportation credits are issued in the local currency. Another issue relates to banks that received government support during the financial crisis. This

support may have come in different forms, ranging from the acquisition of equity shares to recapitalization or other implicit guarantees that one might not be able to perceive (Van Horen and Popov, 2014). For further research, one could try to collect data from a number of publicly available sources on government programs decreed during the sample period and further investigate the effect of such international and domestic supports on *Lending*. We partially control for government support since we use time-varying bank characteristics additionally with bank fixed effects.

6 – Extensive margin

In this section, we first test whether foreign banks were able to amplify the intake of new firms in the post-period. Next, we test whether foreign banks had to end ongoing lending relationships. Our sample selection accounts for all the banking relationships of the 74,117 firms from the *restricted sample*. This is a less strict sample selection, with a larger number of observations (almost 2 million observations on the triplet of firm–bank–time). This sample allows us to detect when a firm started a new banking relationship or ended an ongoing one. We include all possible commercial and universal banks with a commercial portfolio that might appear in and/or disappear from the sample.

In order to test whether the "entry rate" of firms is higher for foreign banks compared with private domestic banks in the post-period, we create the dummy variable *Entry*, which takes the value one when bank-firm relationship enters the dataset (with the exception of the first quarter – 2009:Q4), and zero otherwise. Unlike previously, in this case we start our specifications with no fixed effects. This translates into estimating the following specification:

$$Entry_{i,b,t} = \alpha + \delta_1 Post_t + \delta_2 Foreign_b + \delta_3 Government_b + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \beta_3 X_{b,t} + \varepsilon_{i,b,t} \quad (5)$$

Our more conservative regressions will use firm, bank and time fixed effects without and with time-varying bank controls[31]. We test whether firms are more likely to start a new relationship with another foreign bank in the post-period. This translates into estimating the following specification:

$$Entry_{i,b,t} = \alpha_i + \alpha_b + \alpha_t + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \beta_3 X_{b,t} + \varepsilon_{i,b,t} \quad (6)$$

β_1 is the coefficient of interest.

Column (1) in Table 9 shows that, although not statistically significant, foreign ownership had almost five percentage points effect on the willingness of the bank and a firm to start a new relationship in the post-period. Columns (2) and (3) also show statistically insignificant estimates by adding firm, bank and time fixed effects and by further including time-varying bank controls, respectively.

– Insert Table 9 here –

We next create a variable *Exit*, which is one when bank–firm relationship appears for the last time in the dataset (with the exception of the last quarter–2011:Q3), and zero otherwise. Using *Exit* as the left side variable in equation (5) and (6), we show the results in Column (4) to (6). Foreign banks are more likely to end ongoing relationships, although results are statistically significant only in column (4). Together, the results of entry and exit rates weakly suggest that foreign banks were more relationship intensive, whereas private domestic banks were more concerned with widening relationships. Results are partially in line with Bofondi *et al*. (2013), who

[31] It is true that firm–time fixed effects are well appropriate for the intensive margin analysis but it may not be appropriate for the extensive analysis. The use of firm–time fixed effects diminish firm–time heterogeneity, which, in fact, is part of what we want to capture. Results in such specification are not quantitatively different from those where we apply firm, bank and time fixed effects.

interpret this as a "flight to quality" of foreign banks during the crisis, by concentrating on some relationships and offering less support to fragile borrowers.

7 – Effect of bank ownership on firms with different risk levels

In order to formally test the "flight to quality" hypothesis (*i.e.*, banks concentrate on some relationships and become less supportive of fragile borrowers), we distinguish two groups of firms, depending on their credit risk before 2010:Q4. We separate *Low-risk firms* from *High-risk firms* using a dummy variable that takes the value one if firm rating before the law is equal or above the sample median rating, and zero otherwise[32]. We then interact the dummy variable *Low-risk firms* with *Foreign * Post* and with *Government * Post*, using equations (3) and (4).

The "flight to quality" argument is valid for Brazil if the coefficient for *Foreign * Low risk * Post* is positive, preferably with economic and statistical significance. Table 10 reports our findings. Throughout columns (1) to (3), foreign banks appear as increasing their credit supply to *Low-risk firms* to a higher degree than other banks. Results are economic and statistically significant and reinforce the "flight to quality" behavior of foreign banks during crises.

– Insert Table 10 here –

In order to confirm our findings, in columns (4) to (6) we distinguish *Low-risk firms* from *High-risk firms* by using, respectively, the 25th and the 75th percentiles of firm rating before the law reform. We only keep those firms that are present in the tails bounded by both percentiles. By focusing on the coefficients for *Foreign * Low risk * Post*, we not only confirm our findings but also document an intensified flight-to-quality behavior. Foreign banks decrease *lending* to the highest risk firms and intensify it at a higher degree to the lowest risk firms compared to other bank groups.

[32] Ratings vary from 10 (lowest risk) to 2 (highest risk) and are actually assigned to each loan. By aggregating all loan ratings of a firm with all the banks from 2009:Q4 to 2010:Q3, we create the firm rating. Using firm rating for all the firms in the pre-period allows us to use the median rating as a divider for the groups of firms with different risk levels.

8 – Capital channel

We investigate whether the substitution effect for Brazil operates through the internal capital markets channel. Unfortunately, we are not able to measure internal capital markets directly through bank's balance sheets. Therefore, we use *Equity*, defined as the ratio of equity to total assets, as a proxy for the use of internal capital markets.

As in Europe, the regulatory capital target in Brazil is the Tier 1 capital ratio, which is the ratio of a bank's core equity capital to its total risk-weighted assets (RWA)[33]. The target of Tier 1 capital ratio can be achieved by banks either raising equity or by reducing risky assets, especially in the loan portfolio. We find that foreign banks increased lending to a higher degree than private domestic banks did in the post-period. Additionally, we find that compared with domestic banks in the post-period, foreign banks reduced their exposure to risky assets by increasing credit supply to *low-risk firms* to the detriment of *high-risk firms*.

We then test whether foreign banks did so also by increasing *Equity*. Even though equity is a relatively costly source of finance (Myers and Majluf, 1984), it is possible that the cost of funding in Brazil was higher than the cost of equity in Europe[34] for the time period we consider. If this is true, foreign banks, indeed, had incentives to substitute to Brazil by changing their equity levels. The capital channel specifications are the same as equations (3) with additional variables for analyzing the channel through which the changes in economic conditions in Europe and the Brazilian macro-prudential measures affect *Lending*. The estimated equation is:

$$Lending_{i,b,t} = \alpha_{i,t} + \alpha_b + \tau_1 Foreign_b * Equity_b * Post_t + \tau_2 Government_b * Equity_b * Post_t + \tau_3 Equity_b * Post_b + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \gamma_1 X_{b,t} + \varepsilon_{i,b,t} \quad (7)$$

[33] Risk-weighted assets are the total of all assets held by the bank weighted by credit risk according to a formula determined by the Central Bank of Brazil.

[34] The Selic target rate in Brazil varied from 10.75 to 12.25 during the post-period. Banks need to pay Selic + premium in order to be able to fund themselves locally. According to a survey from KPMG, the cost of equity was estimated to be around 9.6 for the financial services industry in 2010/2011 – (http://www.kpmg.com/DE/de/Documents/Cost_of_Capital_Study_2011-2012-KPMG.pdf).

The coefficient τ_1 on the interaction of *Equity* with *Foreign* and *Post* provides a test of whether the substitution effect operates through the capital channel. A given increase in the bank's equity should have a higher impact on the credit supply of foreign banks. Thus, if bank capital is a channel through which outside economic shocks are transmitted to lending in the Brazilian market, τ_1 should be positive and statistically significant. Results are found in Table 11.

– Insert Table 11 here –

In columns (1) to (3), one can observe that the relationship of *Equity* to *Lending* in the post-period for foreign banks (*Foreign * Equity * Post*) is strong and statistically significant. Results are robust in columns (4) to (6), where we use one quarter lagged channel and further time-varying bank characteristics. Time-varying bank characteristics include the size of the bank, the ratio of liquid assets, deposits, return over assets, international funding, cost of funding, and the size of impaired loans in equations (3) and (6). Results suggest that changes in equity have a sizeable effect on *Lending*. We interpret our findings as evidence that the substitution effect for Brazil operates through the capital channel.

9 – Concluding remarks

International banks are in the core discussions on the causes and effects of financial crises. Since the collapse of the syndicated loan markets in US, we have learned more about the actual transmission of balance sheet shocks, the vulnerability of banks, and about the effectiveness of government interventions in domestic and international contexts. Nonetheless, the risks and benefits of cross-border capital flows continue to pose a challenge to policymakers, in special to central banks, on how to manage capital flows in times of global liquidity shocks.

In this paper, we identify whether and how, during liquidity tensions in their country of origin, foreign banks substitute their investments with *Lending* in Brazil. To this aim, we apply a differences-in-differences analysis, comparing the following dependent variables for different types of bank ownership (foreign, private domestic and government-owned banks) operating in Brazil. We focus on the differences in credit supply, willingness to start (terminate) new (ongoing)

bank–firm relationships, and the shift in risk-taking lending strategies over the transition from 2010 to 2011.

We exploit the Brazilian macro-prudential measures on the fourth quarter of 2010 in a quasi-natural experiment to unfold the substitution effect of foreign banks on *Lending*. In order to control the fast credit growth, the macro-prudential measures decreased the incentives for banks in Brazil to fund themselves locally and abroad (with the exemption of equity investments). Results show that foreign banks increased their supply of credit by six percent after the fourth quarter of 2010, when compared with the level of the private domestic banks. Despite the spillover effects that foreign banks could have received through their bank's balance sheets, we find that the more exposed a foreign bank was to the sovereign crisis, the more they substituted by *Lending* in Brazil. Our estimates fully control for firm unobserved heterogeneity, for all firm-level unobserved heterogeneity that affects the dynamics of credit granted in each period, and for all unobserved time-invariant heterogeneity among lenders, including differences in the composition of loan portfolios, lending policies and managerial risk appetite.

We also investigate the extensive margin of the willingness of foreign banks to start new bank–firm relationships and to terminate ongoing lending relationships over transition from 2010 to 2011. Taken together, the results of "entry" and "exit" rates of firms suggest that foreign banks were more relationship intensive, whereas private domestic banks more concerned with extending relationships further. Results are in line with findings of Bofondi *et al.* (2013), who interpret this finding as a "flight to quality" of foreign banks during the crisis, by concentrating on some relationships and offering less support to fragile borrowers. In order to formally test the "flight to quality" hypothesis, we distinguish groups of firms with opposing credit risk before 2010:Q4. In all tests, we find that foreign banks intensified credit supply to *Low-risk firms* to a greater degree than other bank groups.

We also test whether foreign banks increased *Lending* via the internal capital markets channel. Unfortunately, we are not able to measure internal capital markets directly through the banks' balance sheets. Similarly to Berrospide, Black and Keeton (2013), and De Marco (2015), we use *Equity*, defined as the ratio of equity to total assets, as a proxy for the use of internal capital markets. Even though equity is a relatively costly source of finance (Myers and Majluf, 1984),

results suggest that changes in equity have a sizeable effect on *Lending*. We interpret our findings as evidence that the substitution effect for Brazil operated through the capital channel.

References

Albertazzi, U., and D. Marchetti (2010) "Credit Supply, Flight to Quality and Evergreening", *Bank of Italy Working Paper* No. 756.

Arteta, C., and G. Hale (2008) "Sovereign Debt Crises and Credit to the Private Sector", *Journal of International Economics* 74: 53-69.

Ashcraft, A. (2006) "New Evidence on the Lending Channel", *Journal of Money, Credit, and Banking* 38: 751-776.

Berrospide, J., L. Black, and W. Keeton (2013) "The cross-market spillover of economic shocks through multi-market banks", Finance and Economics Discussion Series, No. 52.

Bertrand M., E. Duflo, and S. Mullainathan (2004) "How Much Should We Trust Differences-in-Differences Estimates?", *Quarterly Journal of Economics*, 119: 249-275.

Bofondi, M., L. Carpinelli, and E. Sette. (2013) "Credit supply during a sovereign crisis", *Bank of Italy Working Paper* No. 909.

Bord, V., and J. Santos (2011) "Banks' Liquidity and Cost of Liquidity for Corporations", *Journal of Money, Credit, and Banking*, Forthcoming.

Brown, C., and I. Dinc (2011) "Too Many to Fail? Evidence of Regulatory Forbearance When the Banking Sector Is Weak", *Review of Financial Studies* 24: 1378-1405.

Buch, C., and L. Goldberg (2014) "International Banking and Liquidity Risk Transmission: Lessons from Across Countries", *Federal Reserve Bank of New York Staff Report* No. 675.

Campello, M. (2002) "Internal Capital Markets in Financial Conglomerates: Evidence from Small Bank Responses to Monetary Policy", *Journal of Finance* 57: 2773-2805.

Central Bank of Brazil, Financial Stability Reports, various years.

Cetorelli, N., and L. Goldberg (2011) "Global Banks and International Shock Transmission: Evidence from the Crisis", *IMF Economic Review* 59: 41-76.

Cetorelli, N., and L. Goldberg (2012) "Banking Globalization and Monetary Transmission", *Journal of Finance* 67: 1811-1843.

Cetorelli, N., and L. Goldberg (2012) "Follow the Money: Quantifying Domestic Effects of Foreign Bank Shocks in the Great Recession", *American Economic Review* 102: 213-18.

Cetorelli, N., and L. Goldberg (2012) "Liquidity management of U.S. Global Banks: Internal Capital Markets in the Great Recession", *Journal of International Economics* 88: 299-311.

Coleman, N., and L. Feler (2014) "Bank Ownership, Lending, and Local Economic Performance during the 2008-2010 Financial Crisis", *International Finance Discussion Papers* No. 1099.

Da Silva, L., and R. Harris (2012) "Sailing through the Global Financial Storm: Brazil's recent experience with monetary and macroprudential policies to lean against the financial cycle and deal with systemic risks", *Central Bank of Brazil working paper series* No. 290.

De Bruyckere, V., M. Gerhardt, G. Schepens, and R. Vander Vennet (2012) "Bank/sovereign Risk Spillovers in the European Debt Crisis" *Journal of Banking & Finance* 37: 4793-4809.

De Haas, R., and N. Van Horen (2012) "International Shock Transmission after the Lehman Brothers Collapse: Evidence from Syndicated Lending", *American Economic Review* 102: 231-237.

De Haas, R., and N. Van Horen (2013) "Running for the Exit? International Bank Lending During a Financial Crisis", *Review of Financial Studies* 26: 244-285.

De Haas, R., and I. van Lelyveld (2010) "Internal Capital Markets and Lending by Multinational Bank Subsidiaries", *Journal of Financial Intermediation*, 19: 1-25.

De Marco, F (2015) "Bank lending and the sovereign debt crisis", Boston College working paper.

Demirgüç-Kunt, A., and H. Huizinga (2013) "Are Banks too Big to Fail or too Big to Save? International Evidence from Equity Prices and CDS Spreads", *Journal of Banking & Finance* 37: 875–894.

Detragiache, E., P. Garella and L. Guiso (2000) "Multiple versus Single Banking Relationships: Theory and Evidence", *Journal of Finance* 55: 1133-1161.

Di Patti, E. and E. Sette (2012) "Bank Balance Sheets and the Transmission of Financial Shocks to Borrowers: Evidence from the 2007-2008 Crisis", Bank of Italy Working Paper No. 848.

Fiechter, J., M. Otker, A. Ilyina, M. Hsu, M. Santos, and J. Surti (2011) "Subsidiaries or branches: does one size fit all?", International Monetary Fund.

Giannetti, M., and L. Laeven (2012) "Flight Home, Flight Abroad, and International Credit Cycles", *American Economic Review* 102: 219-224.

Giannetti, M., and L. Laeven (2012) "The Flight Home Effect: Evidence from the Syndicated Loan Market During Financial Crises", *Journal of Financial Economics* 104: 23-43.

IMF (2012) "Brazil: Financial System Stability Assessment", International Monetary Fund, Country Report No. 12/206.

Ivashina, V., and D. Scharfstein (2010) "Bank Lending During the Financial Crisis of 2008", *Journal of Financial Economics* 97: 319-338.

Iyer, R., S. Lopes, J. Peydró, and A. Schoar (2014) "Interbank Liquidity Crunch and the Firm Credit Crunch: Evidence from the 2007-2009 Crisis", *Review of Financial Studies* 27: 347-372.

Jiménez, G., S. Ongena, J. Peydró, and J. Saurina (2012) "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications", *American Economic Review* 102: 2301-26.

Jiménez, G., S. Ongena, J. Peydró, and J. Saurina (2014) "Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking?" *Econometrica,* 82: 463-505.

Kalemli-Ozcan, S., E. Papaioannou and F. Perri (2013) "Global Banks and Crisis Transmission", *Journal of International Economics* 89: 495-510.

Kashyap, A., and J. Stein (2000) "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?" *American Economic Review* 90: 407-428.

Khwaja, A., and A. Mian (2008) "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market", *American Economic Review* 98: 1413-1442.

Myers, S., and N. Majluf (1984) "Corporate financing investment decisions when firms have information that investors do not have", *Journal of Financial Economics*, 13: 187-221.

Morgan, D., B. Rime, and P. Strahan (2004) "Bank Integration and State Business Cycles," *Quarterly Journal of Economics*, 119: 1555-1584.

Peek, J., and E. Rosengren (2000) "Collateral Damage: Effects of the Japanese Bank Crisis on the United States", *American Economic Review* 90: 30-45.

Peek, J., and E. Rosengren (1997) "The International Transmission of Financial Shocks: The Case of Japan", *American Economic Review* 87: 495-505.

Petersen, M., (2009) "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches", *Review of Financial Studies* 22: 435-480.

Popov, A., and G. Udell (2012) "Cross-Border Banking, Credit Access, and the Financial Crisis", *Journal of International Economics* 87: 147-161.

Popov, A., and N. van Horen (2013) "The Impact of Sovereign Debt Exposure on Bank Lending: Evidence from the European Debt Crisis", *De Nederlandsche Bank Working Paper* No. 382.

Robitaille, P. (2011) "Liquidity and reserve requirements in Brazil", *International Finance Discussion Paper* No. 1021.

Schnabl, P. (2012) "The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market", *Journal of Finance* 67: 897-932.

Figure 1: Summary of the pre- and the post-period

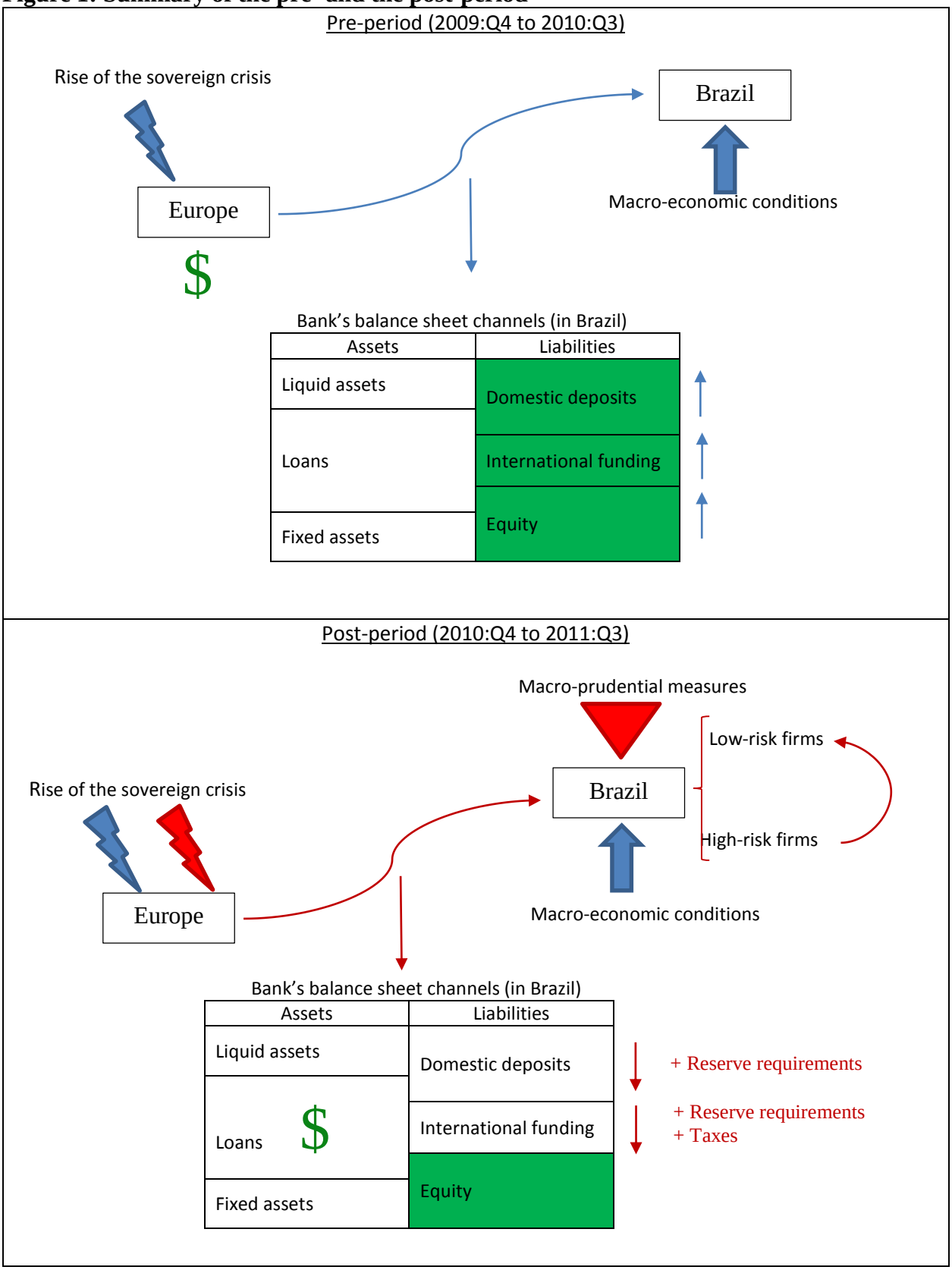


Figure 2: Credit supply by bank ownership – Full sample

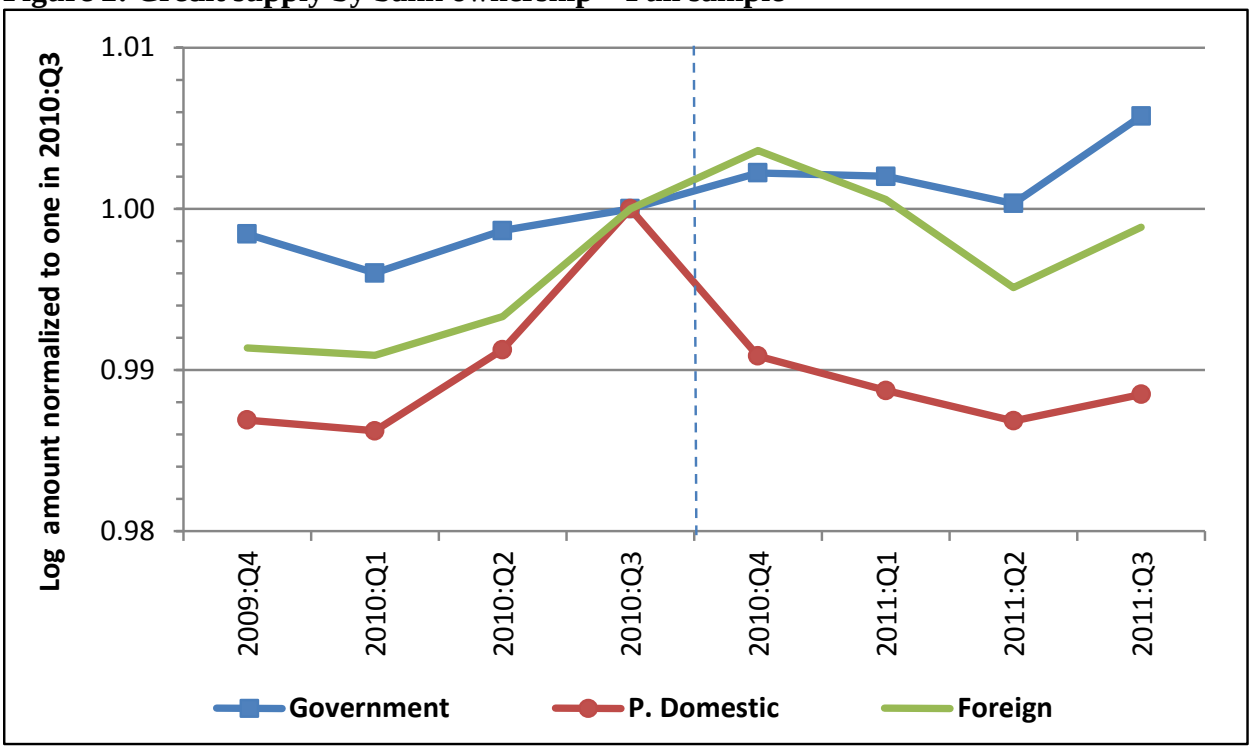


Figure 3: Credit supply by bank ownership – Restricted sample

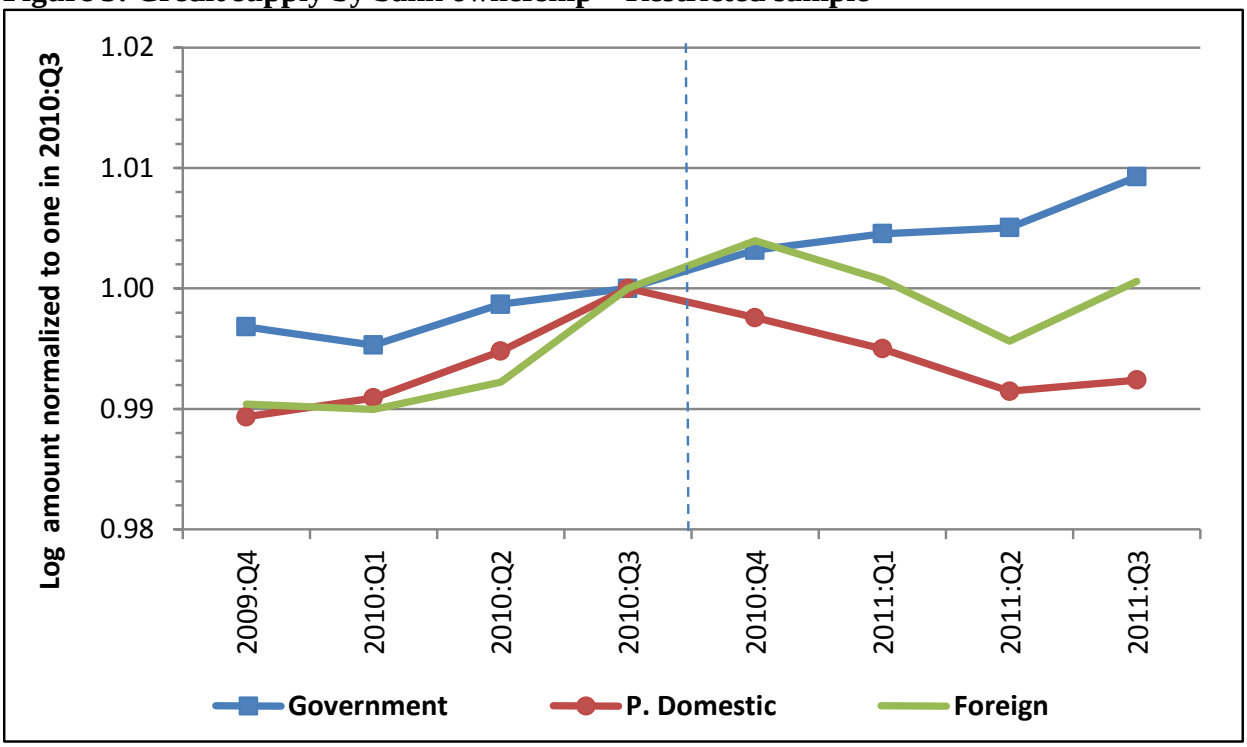


Table 1
Variables definitions

The table presents the definition of variables used in the paper. We use credit registry data, bank ownership data and quarterly accounting information provided by Central Bank of Brazil. CDS spreads come from Datastream.

Variable name	Definition
Lending	Log of outstanding loan amount of borrower *i* at bank *b* in quarter *t*, winsorized on 98%/2% level
Foreign	Dummy variable that takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise
European banks	Dummy variable that takes the value one if ownership control of bank in Brazil is from a European country (with the exception of UK and Switzerland), and zero otherwise
GIIPS banks	Dummy variable that takes the value one if ownership control of bank in Brazil is from a GIIPS country (Greece, Italy, Ireland, Portugal and Spain), and zero otherwise
Government	Dummy variable that takes the value one if bank is public, and zero otherwise
Post	Dummy variable that takes the value one from 2010:Q4 to 2011:Q3 and zero otherwise
Other resources	Ratio of the debt of borrower *i* at bank *b* in quarter *t* issued with resources from other sources than the bank's one to the total quarterly debt of the borrower with the bank
Loan acquisition	Ratio variable of the amount of debt of borrower *i* at bank *b* in quarter *t* acquired but not initiated by the bank itself to the total quarterly debt of the borrower with the bank
CDS spread	Quarterly average Credit Default Swap (5 years bond) of each of the foreign banks divided by 100. CDS spread equals to zero for all domestic and public banks
Size	Log of total assets of the bank, adjusted by official inflation index, winsorized on 98%/2% level
Liquid assets	Ratio of liquid assets to total assets, winsorized on 98%/2% level
Deposits	Ratio of domestic deposits to total assets, winsorized on 98%/2% level
Equity	Ratio of equity to total assets, winsorized on 98%/2% level
Roa	Quarterly return over assets * 100, winsorized on 98%/2% level
International funding	Ratio of international funding (deposits and transfers) to total assets, winsorized on 98%/2% level
Cost of funding	Cost of funding in local currency to current and long term liabilities, winsorized on 98%/2% level
Impaired loans	Non-performing loans divided by total loans of the bank, winsorized on 98%/2% level
Entry	Dummy variable that takes the value one when bank–firm relationship enters the dataset (with the exception of the first quarter), and zero otherwise
Exit	Dummy variable that takes the value one when bank–firm relationship appears for the last time in the dataset (with the exception of the last quarter), and zero otherwise
Low-risk firms	Dummy variable that takes the value one if firm rating before the law reform is equal or above the sample median rating, and zero otherwise. Rating varies from 10 (lowest risk) to 2 (highest risk)
High-risk firms	Dummy variable that takes the value one if firm rating before the law reform is below the sample median rating, and zero otherwise. Rating varies from 10 (lowest risk) to 2 (highest risk)

Table 2
Descriptive statistics

This table presents descriptive statistics of the variables used in the paper for the full and the restrictive sample of firms. The t-test is used to test whether the mean of the pre-period (Post=0) is the same as the mean of the post-period (Post=1).

Variable name	N	Mean	Median	St. dev.	Min	Max	Mean		
							Before	Diff.	T-Test (p-value)
Panel A: Full sample									
Lending	10,080,886	11.06	10.96	1.41	8.53	14.72	11.05	0.02	0.00
Foreign	10,080,886	0.11	0	0.31	0	1	0.11	−0.00	0.21
European banks	10,080,886	0.07	0	0.25	0	1	0.07	−0.00	0.05
GIIPS banks	10,080,886	0.07	0	0.25	0	1	0.07	−0.00	0.05
Government	10,080,886	0.39	0	0.49	0	1	0.40	−0.00	0.00
Post	10,080,886	0.50	1	0.50	0	1	-	-	-
Other resources	10,080,886	0.18	0.00	0.32	0.00	1.00	0.17	0.02	0.00
Loan acquisition	10,080,886	0.02	0.00	0.13	0.00	1.00	0.02	−0.00	0.00
CDS spread	10,080,886	0.15	0.00	0.50	0.00	3.33	0.12	0.07	0.00
High-risk firms	10,080,886	0.50	0	0.50	0	1	-	-	-
Low-risk firms	10,080,886	0.50	1	0.50	0	1	-	-	-
Panel B: Restricted sample									
Lending	1,641,444	12.15	12.04	1.55	9.19	16.16	12.12	0.06	0.00
Foreign	1,641,444	0.38	0	0.48	0	1	0.37	0.00	0.80
European banks	1,641,444	0.26	0	0.44	0	1	0.26	−0.00	0.62
GIIPS banks	1,641,444	0.25	0	0.44	0	1	0.25	−0.00	0.62
Government	1,641,444	0.24	0	0.43	0	1	0.24	−0.00	0.53
Post	1,641,444	0.50	1	0.50	0	1	-	-	-
Other resources	1,641,444	0.14	0.00	0.29	0.00	1.00	0.13	0.01	0.00
Loan acquisition	1,641,444	0.02	0.00	0.12	0.00	1.00	0.02	−0.00	0.07
CDS spread	1,641,444	0.56	0.00	0.84	0.00	3.33	0.43	0.26	0.00
Size	1,641,444	26.53	26.82	1.17	18.65	27.27	26.50	0.08	0.00
Liquid assets	1,641,444	0.39	0.37	0.08	0.06	0.80	0.41	−0.03	0.00
Deposits	1,641,444	0.46	0.47	0.10	0.00	0.80	0.46	−0.01	0.00
Equity	1,641,444	0.10	0.07	0.09	0.03	0.80	0.11	−0.01	0.00
Roa	1,641,444	0.24	0.21	0.27	−2.67	2.86	0.25	−0.02	0.00
International funding	1,641,444	0.02	0.01	0.02	0.00	0.37	0.02	0.00	0.00
Cost of funding	1,641,444	0.02	0.02	0.01	0.00	0.08	0.02	0.00	0.00
Impaired loans	1,641,444	0.06	0.06	0.02	0.00	0.18	0.06	−0.01	0.00
Entry	1,974,179	0.04	0.00	0.2	0	1	0.04	0.01	0.00
Exit	1,974,179	0.03	0.00	0.2	0	1	0.02	0.01	0.00
High-risk firms	1,641,444	0.50	0	0.50	0	1	-	-	-
Low-risk firms	1,641,444	0.50	1	0.50	0	1	-	-	-

Table 3
Descriptive statistics

This table presents the variables used for each group of banks. We show the mean in the pre-period and the additional difference after the macro-prudential measures. The t-test is used to test whether the mean of the pre-period (Post=0) is the same as the mean of the post-period (Post=1).

	Foreign banks			*Government banks*			*Domestic banks*		
Variable name	Before	Diff.	T-Test (p-value)	Before	Diff.	T-Test (p-value)	Before	Diff.	T-Test (p-value)
Panel A: Full sample									
Lending	11.53	0.06	0.00	11.08	0.05	0.00	10.92	−0.03	0.00
Other resources	0.08	0.00	0.42	0.34	0.03	0.00	0.06	0.02	0.00
Loan acquisition	0.00	0.00	0.00	0.00	−0.00	0.19	0.03	−0.00	0.00
CDS spread	1.11	0.64	0.00	-	-	-	-	-	-
Size	26.21	0.10	0.00	26.93	0.03	0.00	26.72	0.12	0.00
Liquid assets	0.37	−0.04	0.00	0.37	−0.05	0.00	0.46	−0.02	0.00
Deposits	0.47	−0.03	0.00	0.49	0.00	0.00	0.46	−0.01	0.00
Equity	0.14	−0.02	0.00	0.06	0.01	0.00	0.10	−0.01	0.00
Roa	0.14	−0.02	0.00	0.34	−0.11	0.00	0.31	−0.01	0.00
International funding	0.01	0.00	0.00	0.03	0.01	0.00	0.02	0.01	0.00
Cost of funding	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.01	0.00
Impaired loans	0.06	−0.01	0.00	0.05	−0.01	0.00	0.06	−0.00	0.00
N. of observations			1,080,170			3,976,217			5,024,499
Panel B: Restricted sample									
Lending	12.04	0.08	0.00	11.99	0.09	0.00	12.29	0.00	0.39
Other resources	0.08	0.00	0.70	0.26	0.03	0.00	0.11	0.02	0.00
Loan acquisition	0.00	0.00	0.00	0.01	−0.00	0.01	0.04	−0.00	0.00
CDS spread	1.15	0.68	0.00	-	-	-	-	-	-
Size	26.24	0.09	0.00	26.94	0.03	0.00	26.46	0.09	0.00
Liquid assets	0.37	−0.04	0.00	0.37	−0.05	0.00	0.46	−0.02	0.00
Deposits	0.46	−0.03	0.00	0.49	0.00	0.00	0.45	−0.00	0.00
Equity	0.14	−0.02	0.00	0.06	0.01	0.00	0.11	−0.01	0.00
Roa	0.14	−0.02	0.00	0.34	−0.01	0.00	0.31	−0.03	0.00
International funding	0.01	0.00	0.00	0.03	0.01	0.00	0.02	0.01	0.00
Cost of funding	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00
Impaired loans	0.06	−0.00	0.00	0.05	−0.01	0.00	0.06	−0.00	0.00
Entry*	0.03	−0.02	0.00	0.03	−0.01	0.00	0.05	0.03	0.00
Exit*	0.01	0.02	0.00	0.02	0.01	0.00	0.03	0.00	0.00
N. of observations			615,857			399,124			626,463

* N. of observations equals 651,661 for firm relationships with foreign banks; 458,764 with government banks, and; 863,754 with private domestic banks.

Table 4
Empirical Strategy

This table introduces the basic empirical strategy. "Before" refers to quarters from 2009:Q4 to 2010:Q3 and "after" refers to quarter from 2010:Q4 to 2011:Q3. We next collapse the data into single data point (based on averages) both before and after. This results in two data points per unit of observation, one data point for the pre-reform regime and one point for the post-reform regime. "Difference" column stands for the difference between "Before" and "After". Standard errors are reported in parentheses. ***, **, * implies significance at 99% level, 95% level, and 90% level, respectively. The data spans the quarters of 2009:Q4 to 2011:Q3.

	Before	After	Difference	N
Panel A: Lending - Full sample				
Foreign banks	11.5116	11.5753	0.0638***	281,652
	(0.0036)	(0.0038)	(0.0053)	
Government banks	11.0530	11.0980	0.0450***	1,027,822
	(0.0016)	(0.0017)	(0.0023)	
Private domestic banks	10.9080	10.8834	−0.0242***	1,297,616
	(0.0018)	(0.0019)	(0.0026)	
Difference (Foreign – Domestic)			0.0574***	
			(0.0017)	
Panel B: Lending - Restricted sample				
Foreign banks	12.0161	12.0979	0.0818***	159,812
	(0.0048)	(0.0050)	(0.0005)	
Government banks	11.9700	12.0612	0.0911***	102,066
	(0.0063)	(0.0066)	(0.0091)	
Private domestic banks	12.2795	12.2781	−0.0014	160,516
	(0.0057)	(0.0060)	(0.0083)	
Difference (Foreign – Domestic)			0.0472***	
			(0.0028)	
Panel C: Lending for specific groups of Foreign - Restricted sample				
European banks	12.0654	12.1556	0.0902***	108,568
	(0.0058)	(0.0059)	(0.0082)	
Other foreign banks	11.9119	11.9757	0.0639***	51,244
	(0.0089)	(0.0092)	(0.0128)	
Government banks	11.9700	12.0612	0.0911***	102,066
	(0.0063)	(0.0066)	(0.0091)	
Private domestic banks	12.2795	12.2781	−0.0014	160,516
	(0.0057)	(0.0060)	(0.0083)	
Difference (European – all others banks)			0.0509***	
			(0.0031)	

Table 5
Effect of bank ownership on bank lending

This table shows the impact of foreign ownership on credit supply. The dependent variable is *Lending* which is the natural logarithm of outstanding loan amount of borrower *i* at bank *b* in quarter *t*, winsorized on 98%/2% level. *Foreign* is a dummy variable that takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise. *Government* is a dummy variable that takes the value one if bank is public, and zero otherwise. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3, and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and in the post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	0.0480	0.0472**	0.0399**	0.0835**	0.0775***	0.0632***
	(0.0359)	(0.0217)	(0.0197)	(0.0365)	(0.0205)	(0.0205)
Government * Post				0.0911	0.0754	0.0846*
				(0.0614)	(0.0482)	(0.0431)
Size			−0.1111			−0.1015
			(0.1313)			(0.1291)
Liquid assets			−0.1351			−0.0765
			(0.2884)			(0.2909)
Deposits			−0.0816			-0.1113
			(0.1622)			(0.1827)
Equity			−1.0757			−1.7306***
			(0.8125)			(0.6491)
Roa			−0.0225			-0.0246
			(0.0280)			(0.0278)
International funding			0.7025			0.8727
			(0.7225)			(0.8004)
Cost of funding			2.2237			3.3787
			(2.2947)			(2.3278)
Impaired loans			−4.6065***			−4.6025***
			(1.1554)			(1.0786)
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444
R-squared	0.14	0.15	0.15	0.14	0.15	0.15

Table 6
Measures of exposure

This table shows three tests on the impact of different groups of *Foreign* on bank lending. The dependent variable is *Lending*. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3, and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. In column (1) to (3), we distinguish European banks (excluding banks from UK and from Switzerland) from other foreign banks using the dummy variable *European*. In column (4) to (6), we focus on banks from GIIPS (Greece, Italy, Ireland, Portugal and Spain) countries by using the dummy variable *GIIPS*. In column (7) to (9), we use the quarterly average Credit Default Swap (spread over bonds of 5years contract) as a continuous exposure variable of foreign banks to the crisis. In this case, we use the interaction Foreign * CDS. Specifications (1) to (9) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and in the post-period. All regressions include bank fixed effects. In addition, column (1), (4) and (7) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance. See table 1 for variable definitions and sources.

	European banks (excluding UK and Switzerland)			Banks from GIIPS countries			Quarterly CDS spread as the continuous explanatory variable		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
European * Post	0.0254	0.0086	0.0909***						
	(0.0164)	(0.0129)	(0.0266)						
GIIPS * Post				0.0281	0.0111	0.0947***			
				(0.0175)	(0.0133)	(0.0271)			
Foreign * CDS * Post							0.0173	0.0031	0.0479***
							(0.0118)	(0.0105)	(0.0158)
Foreign * Post	0.0662*	0.0715***	0.0079	0.0645	0.0698***	0.0061	0.0518	0.0718**	−0.0162
	(0.0392)	(0.0230)	(0.0271)	(0.0397)	(0.0233)	(0.0272)	(0.0459)	(0.0302)	(0.0395)
Government * Post	0.0911	0.0752	0.0744*	0.0911	0.0751	0.0739*	0.0912	0.0753	0.0741
	(0.0614)	(0.0483)	(0.0444)	(0.0614)	(0.0483)	(0.0444)	(0.0614)	(0.0484)	(0.0456)
Bank level controls	No	No	Yes	No	No	Yes	No	No	Yes
Fixed effects									
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444
R-squared	0.14	0.15	0.15	0.14	0.15	0.15	0.14	0.15	0.15

Table 7
Other sample periods

This table shows the impact of foreign ownership on bank lending when conducting two tests with sample periods before the end of 2009. The dependent variable is *Lending*. In column (1) to (3), the sample period goes from 2006:Q3 to 2008:Q2, where *Post* is a dummy variable that takes the value one starting from 2007:Q3 (after tensions in the European interbank market in August 2007). In column (4) to (6) the sample period goes from 2007:Q3 to 2009:Q2, where *Post* is a dummy variable that takes the value one starting from 2008:Q3 (after the collapse of Lehman Brothers in September 2008). Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and in the post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance. See table 1 for variable definitions and sources.

	Sample period from 2006:Q3 to 2008:Q2 (Event August 2007 – Post starts in 2007:Q3)			Sample period from 2007:Q3 to 2009:Q2 (Event September 2008 – Post starts in 2008:Q3)		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.0019	−0.0099	0.0136	−0.0452	−0.0512	−0.0688
	(0.0670)	(0.0492)	(0.0371)	(0.0792)	(0.0506)	(0.0492)
Government * Post	0.0299	0.0171	0.0645	0.0543	0.0443	0.0251
	(0.0837)	(0.0584)	(0.0545)	(0.0785)	(0.0545)	(0.0608)
Bank-level controls	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	945,110	945,110	945,110	1,346,473	1,346,473	1,346,473
R-squared	0.08	0.08	0.08	0.08	0.08	0.08

Table 8
Alternative explanations

This table shows three robustness tests on the impact of foreign ownership on bank lending. The dependent variable is *Lending*. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3 and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. *Other resources* is a ratio of the debt of borrower *i* at bank *b* in quarter *t* issued with resources from other sources than the bank's to the total quarterly debt of the borrower with the bank. *Loan acquisition* is a ratio variable of the amount of debt of borrower *i* at bank *b* in quarter *t* acquired but not initiated by the bank itself to the total quarterly debt of the borrower with the bank. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with one foreign and with one other bank (private domestic or public) in the pre- and in the post-period. Specifications (7) to (9) account for firms with three or more bank relationships, where the firm must have a relationship with a foreign, with a private domestic bank and with a public bank in the pre- and in the post-period. All regressions include bank fixed effects. In addition, column (1), (4) and (7) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance. See table 1 for variable definitions and sources.

	Control for the resource of the money			Control for loan acquisition			Firms with ≥3 relationships		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Foreign * Post	0.1135**	0.1107***	0.0956***	0.0599**	0.0567***	0.0525***	0.0721*	0.0648**	0.0519*
	(0.0463)	(0.0246)	(0.0256)	(0.0275)	(0.0166)	(0.0172)	(0.0370)	(0.0261)	(0.0287)
Government * Post	0.1518**	0.1418**	0.1484**	0.0640	0.0508	0.0636	0.0969	0.0893*	0.0964**
	(0.0756)	(0.0679)	(0.0616)	(0.0585)	(0.0489)	(0.0463)	(0.0659)	(0.0527)	(0.0453)
Other resources * Post	0.1619	0.2676*	0.2543*						
	(0.1206)	(0.1377)	(0.1358)						
Foreign * Other resources * Post	−0.2878**	−0.2860**	−0.2762**						
	(0.1265)	(0.1222)	(0.1209)						
Government * Other resources * Post	−0.2997**	−0.3837***	−0.3692**						
	(0.1228)	(0.1423)	(0.1424)						
Loan acquisition * Post				−0.6617***	−0.6798***	−0.5842***			
				(0.0739)	(0.0967)	(0.1650)			
Foreign * Loan acquisition * Post				0.3481***	0.4062***	0.3229**			
				(0.0916)	(0.1052)	(0.1511)			
Government * Loan acquisition * Post				1.0097***	1.1035***	1.0216***			
				(0.1042)	(0.1120)	(0.1666)			
Bank level controls	No	No	Yes	No	No	Yes	No	No	Yes
Fixed effects									
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	734,486	734,486	734,486
R-squared	0.14	0.15	0.15	0.14	0.15	0.15	0.17	0.17	0.18

Table 9
Extensive margin

This table shows two robustness tests on the extensive margin impact of *Foreign* on bank lending. Our sample selection accounts for all banking relationships of the 74,117 firms from the *restricted sample*. This is a less strict sample selection compared with the *restricted sample*. The larger number of observations allows us to detect when a firm started a new banking relationship or ended an ongoing one. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3, and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. In column (1) to (3), the dependent variable is *Entry*, where it takes the value one when bank–firm relationship enters the dataset (with the exception of 2009:Q4), and zero otherwise. In column (4) to (6), the dependent variable is *Exit*, where it takes the value one when bank–firm relationship appears for the last time in the dataset (with the exception of 2011:Q3), and zero otherwise. Column (2), (3), (5) and (6) include firm, bank and time fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance. See table 1 for variable definitions and sources.

	Entry – start of relationship			*Exit* – end of relationship		
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.0272			0.0040		
	(0.0342)			(0.0054)		
Foreign	−0.0191			−0.0215**		
	(0.0128)			(0.0090)		
Government	−0.0192			−0.0112		
	(0.0158)			(0.0091)		
Foreign * Post	−0.0466	−0.0026	−0.0069	0.0160***	0.0080	0.0052
	(0.0342)	(0.0069)	(0.0162)	(0.0057)	(0.0052)	(0.0046)
Government * Post	−0.0374	0.0050	0.0013	0.0049	−0.0014	0.0010
	(0.0343)	(0.0076)	(0.0160)	(0.0062)	(0.0055)	(0.0051)
Bank-level controls	No	No	Yes	No	No	Yes
Fixed effects						
Firm	No	Yes	Yes	No	Yes	Yes
Bank	No	Yes	Yes	No	Yes	Yes
Time	No	Yes	Yes	No	Yes	Yes
Observations	1,974,179	1,974,179	1,974,179	1,974,179	1,974,179	1,974,179
R-squared	0.01	0.10	0.15	0.00	0.03	0.03

Table 10
Effect of bank ownership on firms with different risk levels

This table shows the impact of foreign ownership on the credit supply for *Low-risk firms*. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3, and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. Specifications (1) to (3) distinguish *Low-risk firms* from *High-risk firms* using a dummy variable that takes the value one if firm rating before the law is equal or above the sample median rating, and zero otherwise. Ratings vary from 10 (lowest risk) to 2 (highest risk). Specifications (4) to (6) distinguish *Low-risk firms* from *High-risk firms* respectively by using the 25th and the 75th percentiles of firm rating before the law reform. We only keep those firms present in the tails bounded by both percentiles. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and in the post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Low-risk firms vs. High-risk firms (defined by the median risk)			*Low-risk firms vs. High-risk firms* (defined by the 25th and 75th percentiles of risk)		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Low risk * Post	0.2711***	0.3111***	0.3176***	0.4004***	0.4310***	0.4466***
	(0.0595)	(0.0773)	(0.0746)	(0.0752)	(0.1094)	(0.1058)
Government * Low risk * Post	0.1361***	0.2068**	0.2148***	0.1916***	0.2559**	0.2723**
	(0.0460)	(0.0788)	(0.0767)	(0.0694)	(0.1164)	(0.1119)
Foreign * Post	−0.0616	−0.0707*	−0.0916**	−0.1434**	−0.1374**	−0.1687***
	(0.0586)	(0.0423)	(0.0445)	(0.0704)	(0.0552)	(0.0578)
Government * Post	0.0179	−0.0132	−0.0069	−0.0115	−0.0166	−0.0203
	(0.0726)	(0.0629)	(0.0584)	(0.0778)	(0.0681)	(0.0608)
Bank-level controls	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,641,444	1,641,444	1,641,444	820,729	820,729	820,729
R-squared	0.14	0.15	0.15	0.13	0.14	0.14

Table 11
Capital channel

This table tests the capital channel of transmission of liquidity tensions to bank lending in Brazil. *Post* is a dummy variable that takes the value one from 2010:Q4 to 2011:Q3, and zero otherwise. The sample period starts in 2009:Q4 and ends in 2011:Q3. In column (1) to (3), we test the capital channel with all variables in level. In column (4) to (6), we test the capital channel with lagged accounting variables. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with one a foreign and with another bank (private domestic or public) in the pre and in the post-period. *Other bank level controls* include all the accounting variables. All regressions include bank fixed effects and firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance. See table 1 for variable definitions and sources.

	Variables in level			Variables lagged		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Equity * Post	1.2147***	1.1021***	1.3806***	1.2175***	1.1081***	1.2130***
	(0.1965)	(0.1362)	(0.1774)	(0.1872)	(0.1336)	(0.2597)
Government * Equity * Post	3.4509	3.8789**	3.3993**	3.1972	3.6039**	3.0501*
	(2.1405)	(1.6882)	(1.6437)	(2.2531)	(1.7742)	(1.6753)
Equity * Post	−1.0038***	−0.9757***	−0.7833***	−1.0099***	−0.9819***	−0.7115***
	(0.1248)	(0.0723)	(0.1978)	(0.1219)	(0.0705)	(0.2069)
Foreign * Post	−0.0440	−0.0322	−0.0742***	−0.0461*	−0.0342*	−0.0581*
	(0.0266)	(0.0205)	(0.0256)	(0.0262)	(0.0206)	(0.0310)
Government * Post	−0.1639	−0.2028*	−0.1698	−0.1502	−0.1877	−0.1388
	(0.1490)	(0.1183)	(0.1180)	(0.1608)	(0.1278)	(0.1230)
Other bank-level controls	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444	1,641,444
R-squared	0.14	0.15	0.15	0.14	0.15	0.15

Appendix Table 1
List of foreign banks

This table shows all the foreign investors present in the sample, their country and their average total assets for the pre and the post-period. We also show whether the foreign investor is included in the group of *Foreign*, *European banks*, after excluding foreign investors from UK and Switzerland, *GIIPS banks* and those for which we find *CDS spread*.

Foreign investor	Country of investor	Total assets (2009:Q4 – 2010:Q3)	Total assets (2010:Q4 – 2011:Q3)	% change	Foreign	European banks	GIIPS banks	CDS spread
B. Nacion Argentina*	Argentina	92	111	0.21	1	0	0	0
B. Provincia de Buenos Aires*	Argentina	155	159	0.03	1	0	0	0
Marsau Uruguay Holdings	Bahrain	8,720	9,620	0.10	1	0	0	0
Bnp Paribas	France	11,800	12,900	0.09	1	1	0	1
Credit Agricole	France	1,870	2,010	0.07	1	1	0	1
Societe Generale	France	5,680	7,290	0.28	1	1	0	1
Commerzbank	Germany	680	492	−0.28	1	1	0	1
Deutsche Bank	Germany	18,000	29,000	0.61	1	1	0	1
WestLB	Germany	3,250	3,030	−0.07	1	1	0	1
Sumitomo Mitsui	Japan	1,370	2,010	0.47	1	0	0	1
Tokyo-Mitsubishi	Japan	1,920	5,210	1.71	1	0	0	1
ING*	Netherlands	2,490	1,810	−0.27	1	1	0	1
Rabobank	Netherlands	8,180	9,640	0.18	1	1	0	0
Banif	Portugal	2,030	2,250	0.11	1	1	1	0
Caixa Geral de Depositos	Portugal	559	876	0.57	1	1	1	0
PAR Participadas	Portugal	437	371	−0.15	1	1	1	0
Korea Exchange Bank	South Korea	151	181	0.20	1	0	0	1
Santander	Spain	393,000	430,000	0.09	1	1	1	1
BP Empreendimentos	Switzerland	265	221	−0.17	1	0	0	0
Credit Suisse	Switzerland	1,850	1,480	−0.20	1	0	0	1
HSBC	UK	125,000	140,000	0.12	1	0	0	1
Nuevo Banco Comercial	Uruguay	256	270	0.05	1	0	0	0
Brascan	US	779	712	−0.09	1	0	0	0
Cargil	US	802	1,070	0.33	1	0	0	1
Citibank*	US	25,300	27,100	0.07	1	0	0	1
Deere & Company	US	2,170	2,460	0.13	1	0	0	1
JP Morgan*	US	13,100	18,500	0.41	1	0	0	1
Total assets		**629,906**	**708,773**	**0.13**				

*Branches of foreign banks in Brazil (information from December 2010).

Chapter 2. The Internal Credit Rating Channel

Bernardus F. Nazar van Doornik
Hans Degryse

Abstract

In this paper, we hypothesize that the international financial crisis that started in August 2007 increased uncertainty across financial institutions, inducing more affected banks to act in a more pessimistic way on the creditworthiness of their commercial borrowers. Using data from the Brazilian credit registry, we compare the credit rating behavior of foreign banks with that of domestic banks during the crisis period, in relation to a common sample of firms. We find that foreign banks gave ratings that were 26 basis points lower in the post-period compared with private domestic banks. Using the definitions of Laeven and Valencia (2012), we select foreign banks directly affected by the financial crisis and find that they gave their borrowers even lower ratings compared with all other types of banks in the post-period. Additionally, using the Laeven and Valencia bank failure dataset, we find that the most fragile banks (*i.e.*, those that received assistance in their home countries), although they did not substantially downgrade their ratings, significantly increased risk provisions in the post-period. We interpret the results as evidence that internal credit ratings can be a channel for the transmission of cross-market risks.

*JEL Classification***:** D81, F34, G18, G21, G24.

Keywords: Risk, credit rating, foreign banks, credit registry.

1 – Introduction

Banks have a competitive advantage in screening and monitoring a firm (Diamond, 1984; Ramakrishnan and Thakor, 1984; Fama, 1985). A continuous and stable bank-firm relationship allows the bank to acquire information about the borrowing firm. If banks have public and private information about a firm, it follows that banks are uniquely suited to assess the risks of their borrowers and hence, banks' internal credit ratings are the best available measure of the risk on the bank's loan portfolio (Mester, Nakamura and Renault, 2007; Nakamura and Roszbach, 2010).

However, it is possible that foreign banks are not well suited to collecting "soft" information about borrowers (Stein, 2002; Canales and Nanda, 2012). Difficulty in collecting soft information on the local market may be especially acute when foreign subsidiaries are far from bank headquarters (Berger and DeYoung, 2006; Mian, 2006). Moreover, foreign banks may revise their perceptions of an entire class of loans based on losses in only some of the countries in which they operate (Van Rijckeghem and Weder, 2003). Thus, a decrease in the quality of borrowers in other markets may cause foreign bank to become more pessimistic about the quality of local borrowers (Berrospide, Black and Keeton, 2013).

In this paper, we test the hypothesis of whether an outside adverse shock affects banks in a heterogeneous way, inducing foreign banks in particular to become more pessimistic about the quality of local borrowers. If this is true, we should be able to capture such behavior through internal credit ratings. Such a finding would be consistent with the idea that foreign banks put more weight on developments in other markets when they have less information about the local markets. The question we raise in this paper could be particularly relevant for countries where credit ratings are shared among banks through public credit registries. If international risks can be transmitted to a local market through the credit rating channel, then the public credit ratings may exacerbate lenders' coordination and increase the incidence of firm financial distress (Hertzberg, Liberti and Paravisini, 2011).

In order to test the potential transmission of risk through internal credit ratings, we use a panel-data sample from the Brazilian credit registry. It consists of quarterly credit data for more than 500,000 firms from 2005 to 2009, where each loan has a credit rating assigned by the bank. All loans to the same borrower are aggregated at bank-firm-quarter level. Overall, there are almost 10 million bank–firm–time observations. From this sample, we select firms that have two or more

bank relationships in the pre- and post-period, allowing us to empirically test risk transmission in a comparative setting (foreign versus domestic banks), using a differences-in-differences methodology.

The two credit rating measures we use as dependent variables are *Risk assessment* and *Risk provision*. *Risk assessment* is defined as the weighted credit rating of all loans assigned by a bank to a borrower at a given quarter. *Risk provision* is defined as the ratio of total due amount provisioned by a bank to a borrower at a given quarter. *Risk assessment* will help us in understanding the dynamics of credit ratings, but it can only be interpreted in an ordinal fashion. *Risk provision,* however, has a cardinal interpretation, which helps us in assessing the average economic magnitude of the results. For example, a downgrade on our scale from "A" to "B" leads to a 0.5% increase in provision, whereas an equally sized downgrade from "C" to "D" leads to a 7% increase in provision. These two one-notch downgrades imply completely different economic effects.

Next, we use the financial crisis as our exogenous event. With the liquidity tensions that spread fast to the Eurozone after August 2007 and with the effects of the collapse of Lehman Brothers in September 2008, the world entered into the worst global financial crisis since the Great depression. As crises inject uncertainty[1] into agents' decision calculus (Widmaier, Blyth and Seabrooke, 2007), parameters become too unstable to quantify the prospects for events that may or may not happen in the future (Keynes, 1937; Lawson, 1985). As Figure 1 illustrates, banks responded to uncertainty with a raised level of mean provision and with an increasing disagreement, measured in terms of standard deviation, of the provision from different lenders to a pull of common borrowers in Brazil.

Using the start of the financial crisis in a quasi-natural experiment, we test whether foreign banks operating in Brazil became more pessimistic about the creditworthiness of a common sample of borrowers compared with domestic banks (private domestic and government banks). Figure 2 and Figure 3 show the dynamics for *Risk assessment* and *Risk provision* by bank ownership from 2005:Q3 to 2009:Q2, respectively. We find empirically that the crisis had an effect on the risk assessment of firms. On average, foreign banks were more aggressive in downgrading their

[1] Knight (1921) was the first to establish the important distinction between risk and uncertainty. Uncertainty must be taken in a sense radically distinct from the familiar notion of risk. It represents the lack of certainty. A state of having limited knowledge where it is impossible to exactly describe the existing state or future outcomes.

borrowers in comparison with private domestic banks during the crisis. In particular, compared with private domestic banks, foreign banks gave ratings to the same borrower that were 26 basis points lower in the post-period. On the other side, government banks displayed the most conservative behavior in the post-period, giving ratings that were 21 basis points higher than those of private domestic banks. However, when we use risk provision in order to capture the economic significance of the more severe downgrade of foreign banks, we lose statistical and economical significance.

In order to further investigate whether credit ratings can be a possible channel for the transmission of cross-market risks, we select banks that were affected by the financial turmoil by using Laeven and Valencia (2012). The authors identify countries in which the financial crisis had started by 2007 and 2008. We find that affected banks gave their borrowers lower ratings compared with all other groups of banks in the post-period. One disadvantage of using the country where the foreign investor is domiciled is that it does not allow one to pinpoint the exact banks that ran into liquidity issues and that indeed needed assistance from their home countries.

Using information from Laeven and Valencia bank failure dataset, we distinguish more "fragile" banks (*i.e.*, those that received assistance in its home countries) and find that their behavior had an economic impact in the post-period. On average, the affected and assisted banks raised risk provision by three percentage points in the post-period compared with private domestic banks. Our findings are evidence that the more banks were affected by the crisis, the more they became pessimistic about the creditworthiness of firms in Brazil. Our findings reinforce the hypothesis that credit ratings can be an important channel for the cross-market transmission of risk.

We use firm fixed effects to compare how the risk for the same firm from a foreign bank changes relative to another bank type (private domestic and government). This within-firm comparison, similar to that of Khwaja and Mian (2008), fully absorbs firm-specific characteristics in credit repayment behavior. Thus, the difference in risk is attributed to differences in bank risk behavior. For robustness, we also test firm–time fixed effects in the regressions, similarly to Popov and Van Horen (2013). The firm–time fixed effects enable one to control for all firm-level unobserved heterogeneity that affects the dynamics of risk assigned in each period, making the comparison of foreign banks with other banks even stricter.

Furthermore, we include bank fixed effects in the regressions so that we can control for all time-invariant unobserved heterogeneity among lenders, including differences in the composition of loan portfolios, lending policies, managerial risk appetite, etc. We further include bank and bank–firm level controls in the regressions including controls for the type of loans. The bank and bank–firm level controls enable one to check whether the inclusion of other covariates changes the impact estimated in the baseline models. Since the residuals may be correlated across banks and across time (Bertrand, Duflo and Mullainathan, 2004), we cluster standard errors at the bank level.

We test whether results are driven by several possibilities. First, foreign banks and other banks should have a similar trend in the pre-period, conditional on all controls. By running a placebo experiment, we find that risk assessment and risk provision of foreign banks were not economically and statistically different from other banks. Another possibility is that a bank's belief that a borrower's creditworthiness has fallen or will fall may cause the lender to reduce the borrower's access to credit, thereby raising the likelihood of default (Carey and Hrycay, 2001). We do not find evidence that foreign banks' negative beliefs on a borrower's creditworthiness caused foreign lenders to reduce the borrower's access to credit. Consequently, we do not find evidence that foreign banks had a direct impact on the likelihood of default of borrowers in Brazil. We also test for the possibility that foreign banks may have downgraded credit ratings because the relationship to their customers was weaker in the pre-period, and of borrower-induced choice of multiple lenders. Results are robust after several tests and in different sample periods.

The finance literature has extensively explored the role of banks in screening and monitoring borrowers. Diamond (1984) and Fama (1985) were the first to hypothesize that banks were more efficient than alternative lenders. One explanation of the superior ability of banks relies on the collection and process of information (Ramakrishnan and Thakor, 1984; Diamond, 1991; Norden and Weber, 2010). In addition to collecting public information, which is available to all lenders, banks possess private information. This private information is derived from the transaction accounts of borrowers, which provides banks with ongoing data on borrowers' activities.

We consider that the goal in collecting and processing information is to produce a measure to assess and monitor the credit risk of a firm. This measure is the credit rating and it represents an evaluation of the creditworthiness of an entity, or more specifically, an assessment of the likelihood that a firm will default on their debt obligations in a given period. Banks had been

assigning credit ratings to their borrowers before, but after the Basel II[2] agreement, in 2004, internal credit ratings became crucial. Basel II encouraged lenders to use public and private information in their own models. Thus, by having access to private and soft information (*i.e.*, transaction account information that provides ongoing data on borrowers' activities, the ability of the manager, their honesty, the way they react under pressure), banks are considered to be uniquely suited to measure the risk of their borrowers. Consequently, bank examiners have been encouraged to use banks' internal credit ratings as the best available measure of the risk of the bank loan portfolio (Nakamura and Roszbach, 2010).

However, few papers analyze the quality of banks' credit ratings. To our knowledge, Nakamura and Roszbach (2010) are the first to empirically test the informational superiority of bank credit ratings over public alternatives. Their findings from two large Swedish banks and a local credit bureau reveal that the internal credit ratings indeed include valuable private information from monitoring, as theory suggests. However, there is evidence that publicly available information from a credit bureau is not efficiently impounded in bank ratings. Their tentative conclusion is that it has proven difficult for these banks to aggregate soft and hard information, and hence risk analyses by banks should be improved. Carey (2002) also presents evidence on the consistency of rating assignments across lenders. His results imply that rating system inconsistencies are a source of material adverse selection and risk for lenders. Additionally, it implies that a lender with a reliable rating system, having confidence in its own system, may have a significant competitive advantage in the long run.

Moreover, banks may have different incentives for assessing the credit risk of borrowers. Recent theories for example have argued that banks screen and monitor more if they have more capital (Holmstrom and Tirole, 1997; Dell-Ariccia and Marquez, 2006). In contrast, Stein (2002) argues that large banks are expected to be less efficient at making relationship loans, because information in a large bank is potentially collected by one individual or group and a decision made by another. In addition to this discussion, Agarwal and Hauswald (2010) find that distance erodes a lender's ability to collect private information. Hertzberg, Liberti, and Paravisini (2010) show that career concerns may cause loan officer credit ratings to be biased optimistically.

[2] The implementation of the Basel II, adapted to the conditions, peculiarities and stage of development of the Brazilian market, follows the directives and timelines published in the central bank of Brazil's official Circular Letters 12.746/2004 and 16.137/2007.

We add to this literature by analyzing the repercussions that an exogenous event might have on the ability of banks (in this case foreign banks) to encompass the informational conditions of a local market when assessing the creditworthiness of a given borrower. Our findings are consistent with the view that greater difficulty in collecting soft information on the local market may be especially acute when foreign subsidiaries are far from bank headquarters (Berger and DeYoung, 2006; Mian, 2006). Additionally, foreign banks may revise their perceptions of an entire class of loans based on losses in only some of the countries in which they operate (Van Rijckeghem and Weder, 2003). Hence, a decrease in the quality of borrowers in other markets may cause foreign bank to become more pessimistic about the quality of local borrowers (Berrospide, Black and Keeton, 2013).

To our knowledge, this is the first paper in the literature that empirically tests for internal credit ratings as a possible channel for the cross-market transmission of risk. We use the financial crisis as an outside shock that affects foreign banks in their country of origin, and we use a sample of Brazilian firms in order to test whether foreign banks became more pessimistic about the quality of local borrowers compared with domestic banks. From a methodological perspective, our paper uses important methodological contributions that include the control of firm-level unobserved characteristics comprising firm fixed effects (Khwaja and Mian, 2008; Schnabl, 2012), and the control of firm–time unobserved heterogeneity by using firm–time fixed effects (Jimenez et. al., 2011; Bofondi et. al, 2013; Popov and van Horen, 2013). Therefore, our approach goes towards an identification through heterogeneity (Buch and Goldberg, 2014) and applies what is *state-of-the-art* in methodological terms.

The rest of the paper is organized as follows. Section 2 describes the credit ratings in Brazil as a possible channel for the cross-market transmission of risks. Section 3 presents the dataset and the main descriptive statistics. Section 4 discusses our empirical strategy and the model we propose to overcome the present challenges. Section 5 contains the results of the baseline specifications, as well as a battery of robustness tests. Finally, section 6 concludes with the main messages of the paper.

2 – Credit ratings in Brazil

Regarding the Brazilian case, resolution 2,682/1999 of the Central Bank established that all financial institutions should classify their credit exposures into nine levels of risk, varying from "AA" and "A" to "H". Rating "AA" represents the best rating a loan can achieve (lowest credit risk) and "H" represents the worst rating a loan can be assigned (highest credit risk). All banks have to maintain an internal credit rating scheme based on the guidelines set by the Central Bank. According to Schechtman *et al.* (2004), the rating process in Brazil must be based on:

(i) analysis of the borrower, including: creditworthiness, indebtedness, capacity to generate cash to repay its debts, quality of earnings, quality of management and internal controls, punctuality, economic activity, commitments; and

(ii) analysis of the credit transaction: the type of loan, the collateral provided, the amount of debt.

Table 1 shows the credit rating scheme used by all banks authorized to operate in the country.

– Insert Table 1 here –

All banks employ the same definition of default, namely:

(i) a bank official has to make a judgment and reach the conclusion that any such payment is unlikely to occur in the future, and

(ii) the principal or interest payments are X days overdue with the bank.

In case of days overdue, the credit rating must be reviewed monthly by the bank and there will be an upper bound for this loan operation. For example, a loan with 92 days overdue will be classified at most at rating "E". According to the same resolution, each rating level is associated with a percentage provision. As a common rule, ratings must be revised at least annually. Finally, all documentation related to the credit risk policy and rating process of a bank must be available for Central Bank analyses.

For the purpose of the research, we use two measures related to the credit ratings. First, in order to facilitate the understanding of the dynamics of credit ratings, we use a numerical

correspondent value for each rating level. Rating "AA" corresponds to a score of 10, rating "A" to a score of nine, rating "B" to a score of eight, until rating "H", which corresponds to a score of two. With these numerical correspondent values, we construct our variable *Risk assessment*, which is defined as the weighted credit rating of all loans assigned by bank *b* to borrower *i* at quarter *t*. *Risk assessment*, however, should only be interpreted in an ordinal fashion. The disadvantage of *Risk assessment* is that it is makes it difficult to assess the average economic magnitude of the results. A downgrade from rating "A" to "B" will have the same importance as a downgrade from "C" to "D".

Each rating level is associated to a percentage provision of the total due amount of the loan. We use this information to construct our second dependent variable, called *Risk provision*, which is defined as the ratio of total due amount provisioned by bank *b* to borrower *i* at quarter *t*. In this case, we use a non-linear correspondent provision for each rating level. Rating "AA" corresponds to a provision of zero percent of total outstanding amount, rating "A" to a provision of 0.5%, rating "B" to a provision of 1%, until rating "H", which corresponds to a provision of 100%. This gives *Risk provision* a cardinal interpretation.

However, the disadvantage of *Risk provision* is that a downgrade of two or more notches on high-quality credit ratings will be less economically meaningful than a one-notch downgrade of low-quality credit ratings. A downgrade from rating "AA" to "D" (four-notches reduction) leads to an increase of 10 percentage points in the provision of total due amount, while a downgrade from "D" to "E" leads to an increase of 20 percentage points. This is relevant, since most of our observations are of high-quality credit ratings.

3 – Data and descriptive statistics

We use credit registry data from the Central Bank of Brazil, which contains specific information on bank–firm credit relationships. The Brazilian credit registry lists all outstanding loan amounts above a threshold of 5,000 Brazilian Real (around 2,500 USD in December 2012) that each borrower has with banks operating in Brazil, including foreign banks. The samples we use from the credit registry include all non-financial and private firms with outstanding credit. We also obtained from the Central Bank consolidated and unconsolidated balance sheet data with

quarterly frequency from all the banks operating in Brazil. Additionally, we have bank ownership and conglomerate information.

We are able to follow the same loans, firms and banks over time. The dataset covers the period starting 2005:Q3, ending in 2009:Q2. Data is available at quarterly frequency and intermediaries use the credit registry as a screening and monitoring device for borrowers. The Central Bank ensures the quality of the data guaranteeing that total outstanding loan amount at the credit registry must match the quarterly accounting figures for credit loan. Moreover, loan-ratings assigned by banks, although not public, are monitored by the Central Bank in order to ensure compliance to the Basel II capital accord[3].

Furthermore, we use Laeven and Valencia (2012) in order to identify the countries that were hit by the financial crisis in 2007 and 2008[4]. Finally, we use the Laeven and Valencia bank failure dataset in order to select parent banks that were more affected by the crisis and had to receive assistance in their home countries. After several examinations to ensure that the data is of high quality, we merge these different datasets using the public bank identification number. The sample of banks includes commercial banks and universal banks with a commercial portfolio[5]. Moreover, banks should appear in the pre- and in the post-period.

In order to test for the possibility of the credit rating channel, we focus on information around the first stage of the international financial crisis, more precisely, after tensions in the European interbank market in August 2007. However, we recognize that the Lehman Brothers' collapse might also be relevant for the credit rating channel. Therefore, we ensure our sample encompasses both events. The sample period goes from 2005:Q3 until 2009:Q2. If credit ratings are indeed a channel of transmission of risks from one market to another, we expect that foreign banks, compared with private domestic banks in the post-period will: (i) downgrade their firms by a more severe degree; and/or (ii) make a bigger increase in the provision of total due amount for their borrowers .

[3] According to BCBS (2013), Brazil is compliant to the Basel II capital accord. The Central Bank monitors the quality of each bank's rating system and supervise the weighting of credit ratings on the computation of bank's total capital requirements for the coverage of credit risk.

[4] The starting date for the recent crises is defined by the domestic banking system showing significant signs of distress followed by government intervention during the starting year of the crisis (Laeven and Valencia, 2012).

[5] The Brazilian Development Bank (BNDES) is excluded from the sample given its particular objectives and operational differences, especially on its cost of funding and its long-term assets.

We analyze eight quarters before the exogenous event and eight quarters after it. Choosing this specification, instead of using five, six or seven quarters before and after, also alleviates concerns with lending seasonality (lending is stronger before Christmas, but weaker before Carnival). As a robustness check, we do the exercise using the period from 2006:Q3 to 2008:Q2, however results are qualitatively unchanged. The same applies when we use the period from 2007:Q3 to 2009:Q2, allowing for the possibility that Lehman Brothers' collapse is the start of the post-period.

We exclude operations in which the origin of the resources is not from the bank itself, reducing the risk that transfers from the Brazilian government or from the National Development Bank may influence our results. Results are robust to the inclusion of other resources. We keep bank–firm relationship if it appears in the pre-period for at least five out of the eight possible quarters; the same applies for the post-period. Therefore, we keep the bank–firm relationship if there is a 62.5% minimum appearance throughout the sample period. However, results are robust to the loosening of such restriction[6].

In the *full sample*, we track 508,394 firms and 105 banks that together result in 665,362 bank–firm pairs. The data level is a triplet on the firm–bank–time dimensions. Our two dependent variables are *Risk assessment* and *Risk provision*. Table 2 shows the definitions of all variables used in our paper.

– Insert Table 2 here –

We use dummy variables to indicate a bank's ownership. *Foreign* takes the value one if ownership control of bank in Brazil is from a foreign country and zero otherwise. *Affected* takes the value one if the parent of the foreign bank in Brazil is from any country where the financial crisis started in 2007 or 2008 (using Laeven and Valencia (2012)), and zero otherwise. *Affected & assisted* takes the value one if the parent of the foreign bank in Brazil received assistance in its

[6] This partially controls for mergers and acquisitions among banks. We further control for M&A and rebalancing of a bank's loan portfolio by tracking whether each loan was initiated by the bank itself, or whether it is a new relationship with the acquirer bank. Results are robust to the exclusion of such loans.

home country (using Laeven and Valencia bank failure dataset), and zero otherwise. Last, *Government* takes the value one if bank is public and zero otherwise. Additionally, we use bank level characteristics, which include the size of the bank, the ratio of credit assets, equity to total assets and return over assets. We also have information on loan amount, collateral, the start date of the relationship between the bank and the firm, and loan type. The controls for loan type are the percentages of loans that are classified as overdraft, factoring, term loan, leasing and export loans (Schnabl, 2012). The omitted category is regular loan.

Table 3 – Panel A shows summary statistics of the variables from the *full sample*.

– Insert Table 3 here –

The median *Risk assessment* of the firms in our *full sample* is 8.16, which corresponds approximately to a "B" rating. The median *Risk provision* is 0.01, which corresponds to 1% provision of total due amount. Foreign banks respond for 11% of the observations on bank–firm relationships. Government banks respond for 43% and private domestic banks for 46% of the firm–bank–time observations. It is important to mention two points. On one hand, the mean *Risk assessment* decreased after the first event of the international crisis in 2007:Q3. Before the crisis, it was 8.10 and it decreased to 7.57 afterwards (−0.53 in the "Diff." column of Table 3). This is a statistically significant change, as we can observe from the *p-value* of the T-Test column. On the other hand, one can notice that the mean *Risk provision* increased substantially (from 0.07 in the "Before" column to 0.14 after adding the amount from the "Diff." column). The increase in *Risk provision* is statistically significant and we interpret it as a first sign of the cross-market transmission of risk.

In order to control for firm unobservable heterogeneity, we select firms with outstanding loan amount from at least two banks from the f*ull sample*. Since the identification strategy relies on a comparison between the behavior of foreign banks and other banks (private domestic and government owned) at the same time, we select firms that borrow from at least a foreign bank and from another bank (private domestic or government owned) in the pre- and in the post-period. This brings us to our r*estricted sample*.

The *restricted sample* permits a powerful identification within borrowers in order to disentangle a bank's belief on the borrower creditworthiness from a firm's overall behavior towards payment obligations. Specifically, we investigate the transmission of risk on the intensive margin on the same firm at the same point in time for foreign banks versus non-foreign banks. In the analyses, we track 40,141 bank–firm pairs with foreign banks, 28,454 with government banks and 33,844 with private domestic banks. There are 37,392 firms in the sample. The data level is a triplet on the firm–bank–time dimensions.

Table 3 – Panel B shows summary statistics of all variables from the *restricted sample*. The median *Risk assessment* is 8.88, which corresponds approximately to "A" rating. The median *Risk provision* is 0.01, which corresponds to 1% provision of total due amount. The mean *Risk assessment* decreased after 2007:Q3 (−0.69 in the "Diff." column of Table 3 Panel B). This is a statistically significant change, as we can observe from the *p-value* of the T-Test column. The mean *Risk provision* increased substantially (from 0.02 in the "Before" column to 0.09 after adding the amount from the "Diff." column). The increase in *Risk provision* is also statistically significant.

In our *restricted sample*, 38% of the observations are of foreign banks. Of these firm–foreign bank relationships, around 98% are with *Affected* banks, and around 50% are with *Affected & assisted* banks. Government banks correspond to 29% and private domestic banks to 33% of the firm–bank–time observations. The median bank in the sample has a size of approximately 222 USD million, with a balance sheet structure of 29% of their total assets invested in credit assets and 7% of total liabilities in the form of equity. The median bank has a net positive income. Moreover, the median relationship loan amount is approximately of 25,000 USD, from which 27% are collateralized. However, there is extreme variance in the cross-section dimension of the banks' balance sheet structure and size. Such balance sheet differences may be correlated with our credit rating measures, so we formally include these variables in the regressions analyses. It is important to cite that systematic differences across banks are controlled in the regressions by bank fixed effects.

Table 4 shows the means of the variables for the group of foreign, public and private domestic banks with their respective t-tests, comparing the mean before and after the crisis event. Regarding foreign banks, the mean of *Risk assessment* from the pre-period to the post-period decreased from 9.11 to 8.30 (−0.81 in the "Diff." column of Foreign banks). Regarding

government banks, it decreased from 8.14 to 7.87, whereas for private domestic banks it decreased from 7.81 to 7.12. In terms of *Risk provision*, the mean for foreign banks from the pre-period to the post-period increased from 0.02 to 0.08 (0.06 in the "Diff." column of Foreign banks). Regarding government banks, it increased from 0.03 to 0.07, whereas for private domestic banks it increased from 0.11 to 0.20. All changes are statistically significant, as we can observe from the p-value of the T-Test column.

– Insert Table 4 here –

The differences in means of *Risk assessment* from foreign banks compared with government or with private domestic banks are statistically significant. In terms of *Risk provision*, the differences in means from foreign banks compared to government are not statistically significant (however, the differences in means from foreign banks compared with private domestic banks are significant). Moreover, foreign banks in Brazil were smaller than other banks, had more credit assets, and made less profit than other banks. The differences in means of balance sheet variables among foreign, private domestic and government banks are also statistically significant, hence the need to include them as variables in the regressions analyses. For the sample of firms we consider, foreign banks have on average greater amounts of outstanding debt amount and more collateralized loans compared with public banks[7]. The differences in means of relationship controls and type of loans among foreign, private domestic and government banks are statistically significant, hence, once again, the need to include them as controls in the regressions analysis.

We recognize that it is possible that our *restricted sample* is not representative of the population of firms in Brazil. As we do not know the public identity of the firm, their location, nor their industry, it is difficult for us to give an account of the importance and the direction of the selection bias. We test for the significance of the difference of coefficients of our measures between the full and the restricted sample, both in Table 3 and in Table 4. We find that the

[7] The information that foreign banks had on average greater amounts of outstanding debt amount is not consistent with the numbers of total loan volumes from the Brazilian financial stability reports. According to BCB (2008), foreign banks had a 21.3% market share on the total local credit volume in mid-June 2008, whereas public banks had 30.1% and private domestic banks corresponded to 48.6%.

coefficients are not economically significant. However, as we select firms with multiple banking relationships, these firms are expected to be larger firms.

Appendix Table 1 provides a list of all the foreign investors that own and control banks in Brazil, and that are present in our sample. We additionally present their country and their average total assets for the pre- and post-period. In total, there are 28 foreign investors. The majority of banks are owned by American parent banks and institutions, although the biggest player at the time was the Dutch ABN Amro Bank (acquired in 2008 by Santander), followed by Santander from Spain and HSBC from UK. Banks that increased the extent of their participation the most during the sample period were Barclays with 131% increase in total assets, followed by the Korea Exchange Bank with 95%, and the Korea Development Bank, with 90%. On the other hand, UBS decreased its size by 19%, followed by Brascan with a 10% lower figure, and Citibank by 4%[8]. Foreign banks increased their size by 27% in two years, even though, by the end of 2008, the participation of foreign banks was still small compared to neighboring countries, with 22% participation on the overall Brazilian market (IMF, 2012).

– Insert Appendix Table 1 here –

Additionally, Appendix Table 2 lists the foreign banks that received assistance in their country of origin with further details on the type and main features of the intervention/resolution. Data is from Laeven and Valencia bank failure dataset.

– Insert Appendix Table 2 here –

[8] These average figures would correspond to a comparison of total assets of the banks from September 2006 to September 2008. The overall effect of the financial crisis on some foreign banks is more severe. Appendix Table 2 describes the interventions suffered by some of the foreign parent investors of banks in Brazil (Laeven and Valencia bank failure dataset).

4 – Empirical strategy

4.1 – Empirical Issues

The goal of this paper is to identify whether international financial shocks can be transmitted to a local market through the credit rating channel. However, identifying a causal effect of the transmission of risk poses important challenges.

First, if it is true that a bank may become more pessimistic about the quality of local borrowers because of an outside adverse shock, we should be able to capture such behavior through the credit ratings measures. However, there is a lack of a common identification system for loans and borrowers, making development of large samples difficult, as the matching of observations across lenders is a laborious task (Carey, 2002). We overcome this difficulty given the richness of the dataset that allows us to identify banks, firms, and loans over time. Given the several loan characteristics the dataset possesses, we are able to observe the dynamics of ratings for each loan and the date of origination, among several other variables.

Second, differences in the granularity of internal rating scales and in the timing of rating assignments and reviews complicate the interpretation of results (Carey, 2002). The granularity of internal ratings is not an issue in the present study, since all banks in Brazil employ the same guidelines for the definition of default, given by the Resolution 2.682/1999 of the Central Bank. The Brazilian regulations do not employ external credit ratings, and instead use the Basel national discretions (BCBS, 2013). The same rules apply for all institutions authorized to operate in the country, regardless of ownership control. Timing of rating assignments is not a major concern as the rating for each loan is sent monthly to the same credit registry. Finally, by using a sample of eight quarters before and after the tensions in the European interbank market in August 2007, we believe we are able to capture the rating reviews that could have taken place because of the crisis events.

Next, a potential difficulty with ratings is that they may be endogenous. A bank's belief that a borrower's creditworthiness has fallen or will fall may cause the lender to reduce the borrower's access to credit, thereby raising the likelihood of default (Carey and Hrycay, 2001). We believe endogeneity is not a major issue in the present study for the following reasons. First, because we account for firms with two or more bank relationships where the firm must have a relationship with a foreign and with another bank (private domestic or public). If a bank's belief that a

borrower's creditworthiness has fallen or will fall were to induce the bank to reduce the borrower's access to credit, the firm could still try to access credit with the other lenders. Multiple bank relationship helps to mitigate the credit rationing effect that we believe would be more prominent in firms with a single-lender relationship.

Second, given the Brazilian credit registry characteristics (*i.e.*, a bank does not have access to the credit rating assigned by another bank), even in the case that a bank does decide to downgrade a firm based on its own belief, this bank's decision would not induce other banks to downgrade the firm. Moreover, since we control for firm time-varying unobserved heterogeneity (e.g., using firm–time fixed effects), we are also controlling for the effect of the borrower's access to credit on the overall change in the borrower's creditworthiness. Even in a setting where the likelihood of default is raised by a lack of credit, we control for the time-varying outstanding loan amount between the bank and the borrower in some of our specifications. Finally, we run regressions for the restricted sample of firms using credit supply as our dependent variable. The results from this specific exercise show that lending from foreign banks is not different from private domestic banks in the post-period. Therefore, ratings downgrades from foreign banks did not come with a more severe credit rationing.

Moreover, one should be able to identify banks, otherwise comparable, that have been differently affected by the financial crisis. Since private domestic and government owned banks are located within Brazil, with limited foreign exposure, we consider foreign banks as the more "affected" group, or in other words, the group we aim to further investigate. In principle, foreign, private domestic and government banks may differ along several dimensions, and comparing them to assess the effect of the financial crisis on local credit rating measures may not be warranted. Our identification strategy, based on comparing credit rating measures applied by different banks to the same firm, allows us to fully control for possible differences in the composition of borrowers across different types of banks.

We take *Risk assessment* and *Risk provision* as different measures of credit risk that may complement each other. As we focus our analyses in a differences-in-differences approach, by comparing the behavior of foreign banks to other banks after the crisis, ideally we expect to find:

(i) negative and statistically significant estimates for *Risk assessment* from foreign banks in the post-period; and

(ii) positive and statistically significant estimates for *Risk provision* from foreign banks in the post-period.

If it is true that a bank may become more pessimistic about the quality of local borrowers because of an outside adverse shock, preferably, we should be able to capture such behavior through both credit ratings measures (*Risk assessment* and *Risk provision*). We would interpret this as strong evidence for the transmission of risk through the credit rating channel. However, given the characteristics of each of our credit rating measures for each of the bank groups, we expect to find results for either *Risk assessment* or *Risk provision*. We would interpret this as weak evidence for the transmission of risk through the credit rating channel.

In order to better illustrate our main identification strategy, we show Table 5 where we collapse the data into single data point (based on averages), both before and after the reform. This results in two data points per unit of observation, one data point for the pre-period and one point for the post-period. This time-collapsing of the data ensures that the standard errors are robust to Bertrand, Duflo and Mullainathan (2004) critique[9].

– Insert Table 5 here –

In Panel A1, we report the before–after results of the variable *Risk assessment* for the three groups of banks using the *full sample*. *Risk assessment* for foreign banks decreased by 0.88 basis points after the reform (−0.8765 in the Difference column), whereas government banks decreased by 0.31 and private domestic decreased by 0.69. *Risk assessment* for firms with multiple banking relationships after the reform decreased more for foreign banks, with a minus 0.37 basis points in comparison to domestic banks (-0.3660 in the Difference column for "Difference (Foreign–Domestic)"). We also test the difference in the mean figure for *Risk provision* before and after 2007:Q3 for the three groups of banks. Results can be found in Table 5, Panel A2. As one can see in the column "Difference (Foreign–Domestic)", the difference in foreign banks compared with

[9] Bertrand, Duflo and Mullainathan (2004) critique relates to serial correlation - the tendency for one observation to be correlated with those that have gone before – especially in differences-in-differences models. The simplest and most widely applied approach is simply to time-collapse the data. We believe that our number of bank clusters does not cause biased standard errors or misleading estimates.

other banks in relation to the mean in the pre-period to the post-period is economically and statistically insignificant. In Panel B1 and B2, we use information from our *restricted sample*. Results for the "Difference (Foreign–Domestic)" are similar to the results from the *full sample*.

In summary, we identify the impact of the financial crisis on credit rating measures by comparing the pre- and the post-patterns of *Risk* applied to the same firm by two or more banks, where the firm must have a relationship with one foreign and with another bank (private domestic or public). We believe that our specific sample around the economic conditions of the aftermath of the 2007-2008 financial crisis makes the appropriate setting for the present study. Given the considerably large number of bank–firm relationships we trace, inferences are robust enough to enlighten our knowledge regarding the cross-market transmission of risk through the credit rating channel.

4.2 – The model

We use credit registry data on the firm–bank–quarter level. We use the following specification to investigate whether foreign banks differ with respect to the *Risk assessment* and *Risk provision* in the post-period compared with other banks. We start with a specification with firm, bank and time fixed effects.

$$Risk_{i,b,t} = \alpha_i + \alpha_b + \alpha_t + \beta_1 Foreign_b * Post_t + \varepsilon_{i,b,t} \quad (1)$$

where *Risk* equals *Risk assessment* or *Risk provision*, depending on our regressions. *Foreign* is a dummy variable that takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise. *Post* is a dummy variable that takes the value one from 2007:Q3 to 2009:Q2 and zero otherwise. The sample period starts in 2005:Q3 and ends in 2009:Q2. As stated before, we include a full set of firm, bank and time fixed effects, respectively α_i, α_b and α_t, controlling for unobserved time-invariant heterogeneity at each of the triplet dimensions. $\varepsilon_{i,b,t}$ is an idiosyncratic error term. Since the residuals may be correlated across banks and across time (Bertrand, Duflo and Mullainathan, 2004), we cluster standard errors at the bank level.

One challenge is the simultaneous nature of the bank and the firm behavior regarding credit ratings, since it is hard to disentangle a bank's belief on the borrower creditworthiness from the firm's overall behavior towards payment obligations. We completely capture any risk shocks at the firm level by using firm–time fixed effects controls, $\alpha_{i,t}$. This comes at the cost of needing to restrict our analysis to those firms with multiple bank relationships at the same time. In our case, we restrict the firms to those having a relationship with one foreign and with another bank (private domestic or public) in the pre- and post-period. The most saturated specification is:

$$Risk_{i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \gamma_1 X_{b,t} + \gamma_2 Y_{i,b,t} + \gamma_3 W_{i,b,t} + \varepsilon_{i,b,t} \quad (2)$$

where vector $X_{b,t}$ controls for a set of observable characteristics of bank *b* at time *t*, including size of the bank, ratio of credit assets, equity to total assets and Roa. Vector $Y_{i,b,t}$ controls for a set of observable relationship characteristics of bank *b* with borrower *i* at time *t*, including outstanding amount of debt, presence of collateral, and the importance of the oldest bank for the firm. Vector $W_{i,b,t}$ controls for loan type as percentages of loans that are classified as overdraft, factoring, term loans, leasing, and export loans (Schnabl, 2012). The omitted category is regular loan. Therefore, we are able to control for further bank-specific and bank–firm-specific determinants of *Risk* not captured by the specified fixed effects. In order to check whether the inclusion of other bank and bank–firm covariates change the impact estimated in the baseline model, we also show estimates of equation (2) without vector $X_{b,t}$, vector $Y_{i,b,t}$, nor with vector $W_{i,b,t}$.

We know that government banks were countercyclical during the financial crisis (Coleman and Feler, 2014). One hypothesis is that government banks have assessed the risk of their borrowers in a more detached way, compared with private banks. Therefore, we also estimate the following:

$$Risk_{i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \gamma_1 X_{b,t} + \gamma_2 Y_{i,b,t} + \gamma_3 W_{i,b,t} + \varepsilon_{i,b,t} \quad (3)$$

where *Government* is a dummy variable that takes the value one if bank is public, and zero otherwise. Therefore, the comparison becomes the change in *Risk*, from the pre to the post period, for foreign banks relative to the control group, which is private domestic banks in the case above.

The coefficient of interest in all equations above is β_1. In a difference-in-differences approach, β_1 captures the change in the risk assessment, from the pre-treatment to the post-treatment period, for the treatment group (foreign banks) relative to the control group (private domestic and government banks in equation (1) and (2) and private domestic banks in equation (3)). The numerical estimate of β_1 captures the difference in the change of the bank–firm risk relationship between the pre- and the post-period induced by moving from the control group to the treatment group.

As stated above, we control our regressions for bank-specific time-invariant characteristics, since we include bank fixed effects in the regressions. We also control for bank-firm relationship features by using bank-firm variables such as the outstanding amount of debt, presence of collateral, and the importance of the oldest bank for the firm. Furthermore, we control for the composition of bank–firm relationship (*i.e.*, the use of different banks for different purposes), by aggregating loans in types as Schnabl (2012) does. However, the validity of the identification strategy depends on a similar trend in the pre-period of the variable *Risk* from foreign banks and other banks, conditional on all controls. The requirement for a similar trend only applies to how much foreign banks, private domestic banks and government banks depart from their time-invariant component in the pre- and post-period. Results in a previous placebo test are not significant throughout all specifications, pointing to the validity of the main results of the paper.

5 – Empirical evidence

5.1 – Baseline model

Tables 6 and 7 provide the first results of the paper. In Table 6, we regress *Risk assessment* on foreign bank ownership in the post-period in a differences-in-differences approach. Columns (1) to (3) show the effect of the dummy foreign on risk assessment in the period from 2007:Q3 to 2009:Q2. In column (1), we present the results of equation (1). The estimate of coefficient β_1 (for

the interaction term of interest $Foreign_b * Post_t$) is negative, statistically significant, and economically meaningful. Results show that in response to the crisis, foreign banks are giving a rating which is 35 basis points lower *vis-à-vis* that of domestic banks (to the same borrower). Here, we include bank, firm, and time fixed effects, but do not control for time-varying bank and bank–firm characteristics. In order to address for the possibility that there are time-varying differences in borrower behavior, in column (2) we include firm–time fixed effects. In this setting, results remain statistically significant. Results are also robust when we control for time-varying bank, bank–firm characteristics and loan type variables, as one can observe in column (3), which are the results of equation (2).

– Insert Table 6 here –

Brazilian government banks were countercyclically active during the global financial crisis (IMF, 2012). They provided more credit, offsetting declines in lending by private banks (Coleman and Feler, 2014). With this argument, we regress *Risk assessment* on foreign and government bank ownership in the post-period. In equations (4) to (6), the comparison of interest is foreign banks versus private domestic banks in 2007:Q3 and after. In column (4), one can observe the conservative behavior of government banks in the post-period compared with private domestic banks. While foreign banks seem to have been the most aggressive group of banks in downgrading credit ratings, government banks were the most conservative group, with ratings at 23 basis points above ratings of private domestic banks.

Column (6) of Table 6 tests equation (3) and presents the preferred estimation providing an unbiased estimate on risk assessment. *Ceteris paribus*, risk assessment of foreign banks suffered a higher level of deterioration compared with private domestic banks. In response to the crisis, foreign banks are giving a rating which is 26 basis points lower *vis-à-vis* that of private domestic banks (to the same borrower). Because specification (6) includes saturated fixed effects and time-varying bank and bank-firm controls, it is unlikely that the results are driven by unobservable time-varying differences in borrower demand and quality. Neither are results driven by time-invariant bank heterogeneity, time-varying differences in bank's structure, behavior or risk appetite; nor by time-varying differences in firm behavior.

In Table 7, we regress *Risk provision* on foreign bank ownership in the post-period using the same differences-in-differences approach. Columns (1) to (3) show the effect of the dummy foreign on risk provision in the period from 2007:Q3 to 2009:Q2 in comparison to domestic banks. In equations (4) to (6), the comparison of interest is foreign banks versus private domestic banks. In all columns, the estimate of coefficient β_1 is statistically and economically not significant.

– Insert Table 7 here –

Table 6 shows that the difference in *Risk assessment* between foreign and other banks is relevant in the post-period. However, Table 7 shows that we lose significance when we test *Risk provision* for foreign banks in the post-period. Taken together, the results of Tables 6 and 7 present weak evidence of the cross-market transmission of risk through the credit rating channel.

5.2 – Exposure measures

One question that remains is whether different groups of foreign banks, depending on their exposure to the international financial crisis, behaved differently during the baseline sample period.

In order to select banks that were more affected by the financial turmoil, we first use Laeven and Valencia (2012), who show the markets affected by the 2007-2008 financial crisis. According to the authors, the starting date for the recent crises is defined by banking system showing significant signs of distress followed by government intervention during the starting year of the crisis. Using Laeven and Valencia (2012), we create *Affected*, which is a dummy variable that takes the value one if the parent of the foreign bank in Brazil is from any country where the financial crisis started in 2007 or 2008, and zero otherwise[10]. The hypothesis we raise is that the financial crisis may have increased the incentives for more affected banks to downgrade their borrowers in an even more severe way in the post-period. In Table 8, columns (1) to (3) we report estimates of the impact of *Affected* on risk assessment.

[10] See Appendix Table 1 for specific banks considered as *Affected*.

– Insert Table 8 here –

In column (1), one can note that *Affected* indeed gave their borrowers lower ratings compared with private domestic banks. On average, *Affected* are giving ratings that are 93 basis points lower in the post-period than the comparison group. When we move to column (2), where we include firm–time fixed effects, the estimated impact for foreign affected in the post-period is 50 basis points lower than that of the comparison group. The difference between the estimates of column 1 and 2 is evidence of considerable time–series variance within firm–bank risk relationship (*e.g.*, new loans appearing and old loans disappearing from the credit registry). This variance is therefore mitigated by the use of firm–time fixed effects. Results are also robust when we control for time-varying bank, bank–firm characteristics and loan type variables, as one can observe in column (3).

In Table 8, columns (4) to (6) we report estimates of the impact of *Affected* on risk provision. In column (4), *Affected* increased risk provision compared with private domestic banks. On average, *Affected* raised provision by five basis points in the post-period compared with private domestic banks. When we move to column (5), where we include firm–time fixed effects, the estimated impact for foreign affected is still positive, but with no statistical significance. Results continue to be not significant when we control for time-varying bank, bank–firm characteristics and loan type variables, as one can observe in column (6).

Interesting to note that less-affected foreign banks (Foreign * Post), corresponding to approximately 2% of the observations of foreign banks, increased (decreased) *Risk assessment* (*Risk provision*) above (below) the level of government banks in the post-period. In a similar argument as in Kempf, Manconi and Spalt (2014), an alternative explanation for the behavior of less-affected foreign banks can be the distraction of parent banks, in which an unrelated shock shifts their attention, leading to a temporary loosening in the behavior of their foreign subsidiaries.

In any case, one disadvantage of using the country where the foreign investor is domiciled is that it does not allow one to pinpoint the precise banks that ran into liquidity issues and that indeed needed assistance from their home countries. Using Laeven and Valencia bank failure dataset, we create *Affected & assisted*, which is a dummy variable that takes the value one if the

parent of the foreign bank in Brazil received assistance in its home country, and zero otherwise[11]. We raise the hypothesis that the behavior for the most affected banks could have been different from the *Affected* group.

In Table 9, columns (1) to (3) we report estimates of the impact of *Affected & assisted* on risk assessment.

– Insert Table 9 here –

Estimates are not statistically significant, pointing to a heterogeneous behavior of foreign banks that received assistance in the post-period. However, results for risk provision in columns (4) to (6) show that even though *Affected & assisted* did not downgrade ratings more than private domestic banks, their movement had an economic impact in the post-period. On average *Affected & assisted* raised risk provision by three percentage points in the post-period compared with private domestic banks. Our findings are evidence that more affected banks became more pessimistic about the creditworthiness of firms in Brazil during the crisis and this reinforces our hypothesis that credit ratings can be an important channel for the cross-market transmission of risk.

5.3 – Robustness

There are several possible concerns regarding the estimates. We consider a number of robustness tests and alternative explanations that may fully or partially account for the results reported in Table 6 to Table 9.

[11] See Appendix Table 1 for specific banks that received assistance. See Appendix Table 2 for the list of foreign banks that received assistance in their country of origin with further details on the type and main features of the intervention/resolution.

5.3.1 – Placebo experiments

The first possibility we address is that foreign banks and other banks did not have a similar trend in the pre-period, conditional on all controls. Because all the regressions include bank fixed effects, we are already controlling for bank-specific time-invariant characteristics. Therefore, the requirement for a common trend would only apply to how much foreign banks, private domestic banks, and government banks depart from their time-invariant component in the pre and post-period.

We conduct a placebo test to address this issue in Table 10. In column (1) to (6), the sample period goes from 2003:Q4 to 2007:Q2, where *Post* is a dummy variable that takes the value one starting from 2005:Q3. Columns (1) to (3) show the effect of the dummy foreign on risk assessment in the post-period. Columns (4) to (6) show the effect of the dummy foreign on risk provision in the post-period. In columns (1) and (4), one can observe that a placebo event in August-September 2005 had, on average, an economically and statistically significant impact on risk assessment and on risk provision of foreign banks operating in Brazil. Specifications (1) and (4) include bank, firm and time fixed effects.

– Insert Table 10 here –

However, when we replace firm and time fixed effects for firm–time fixed effects (specifications (2) and (5)), results lose statistical significance. Again, this is evidence that there is considerable time–series variance within firm–bank risk relationship (*e.g.*, new loans appearing and old loans disappearing from the credit registry). This variance is mitigated by the use of firm–time fixed effects. Columns (3) and (6) include time-varying bank, bank-firm controls and loan type variables, and are our preferred estimations, providing an unbiased estimate on the behavior of foreign banks during the placebo period. *Ceteris paribus*, risk assessment and risk provision of foreign banks in the post-period are not economically and statistically different from other banks.

5.3.2 – Effect of bank ownership on Lending

One concern regarding the results is that a bank's belief that a borrower's creditworthiness has fallen or will fall may cause the lender to reduce the borrower's access to credit, thereby raising the likelihood of default (Carey and Hrycay, 2001). Indeed, we find that foreign banks were more aggressive in downgrading credit ratings compared with other bank groups in Brazil. However, in order to find evidence that credit rationing was more severe from foreign banks in the post-period, we run the same exercise we did in section 5.1, but now using the dependent variable *Amount*, instead of our previous credit rating measures.

Amount is defined as the log outstanding loan amount of borrower *i* at bank *b* in quarter *t*, winsorized on 98%/2% level. In fact, it is a measure to test the credit supply of foreign banks in Brazil. The results of the effect of bank ownership on lending can be found in Table 11.

– Insert Table 11 here –

As we can observe, credit supply of foreign banks in the post-period is not statistically significant in any of the specifications. With no further developments, we do not find evidence that foreign banks' negative beliefs on a borrower's creditworthiness caused foreign lenders to reduce the borrower's access to credit. Consequently, we do not find evidence that foreign banks have a direct impact on likelihood of default of borrowers in Brazil.

5.3.3 – Composition effect hypothesis

Another possible concern regarding the results is that foreign banks may have downgraded credit ratings because the relationship to their customers was weaker in the pre-period (following same reasoning of De Haas and Van Horen (2013) regarding lending). Moreover, there might be a borrower-induced choice of multiple lenders (*i.e.*, borrowers who borrow from a historically weak domestic bank, try to compensate with a stronger foreign bank). In order to reduce these possibilities, we keep firm–bank relationship if it appears in the pre-period for at least five out of the eight possible quarters; the same applies for the post-period. Therefore, regressions include bank–firm relationship if there is a 62.5% minimum appearance throughout the sample period.

However, in order to control for the composition effect hypothesis in a stricter sense, we account for firms with three or more bank relationships, where the firm must have a relationship with one foreign, with a private domestic bank, and with a public bank in the pre- and post-period. Since results for *Risk provision* are not significant for our baseline results, we focus the analysis in the variable *Risk assessment*. Results can be found in Table 12.

– Insert Table 12 here –

Columns (1) to (3) show the effect of the dummy foreign on risk assessment in the post-period compared with domestic banks (government and private domestic banks). In equations (4) to (6), the comparison of interest is foreign banks versus private domestic banks. Even in a setting where we include saturated fixed effects and time-varying bank and bank–firm controls (columns (3) and (6)), results continue to hold. The main findings of the paper are not driven by the possibility of borrower-induced choice of multiple lenders nor by the possible different purposes that different banks might have for a given firm.

5.3.4 – Sample periods

Table 13 reports results on the criterion used to split sample periods. One argument could be that the sample period of eight quarters in the pre-period and other eight quarters in the post-period is too wide. To address this concern, in column (1) to (3), we keep the sample period from 2006:Q3 to 2008:Q2, instead of 2005:Q3 to 2009:Q2. *Post* continues as a dummy variable taking the value one starting from 2007:Q3. Since results for *Risk provision* are not significant for our baseline results, we focus the analysis in the variable *Risk assessment*. The results suggest that a smaller sample that excludes the Lehman Brothers' collapse in September of 2008 also captures the foreign bank behavior regarding *Risk* in the post-period.

– Insert Table 13 here –

The next concern we address regards the extent to which a sample period closer to the collapse in syndicated lending during the global financial crisis affected foreign banks. In column (4) to (6), we therefore extend the sample period back from 2007:Q3 to 2009:Q2, instead of 2005:Q3 to 2009:Q2. Here we split the sample using *Post* as a dummy variable that takes the value one starting from 2008:Q3, instead of 2007:Q3. In this specific setting, evidence is also negative and economically significant, suggesting the bank-firm risk relationship continued being more downgraded by foreign banks after the 2008 financial crisis.

6 – Concluding remarks

In this paper, we hypothesize that the international financial crisis that started in August 2007 increased uncertainty across financial institutions, inducing more affected banks to act in a more pessimistic way on the credit rating of commercial borrowers (compared with domestic banks). Thus, we empirically test for internal credit ratings as a possible channel for the cross-market transmission of risk.

We find evidence that foreign banks, especially those whose parent banks were most challenged by the turmoil of the crisis, revised ratings downward in a more severe manner than other banks did after the crisis. Our results suggest that risks can be transmitted from one market to another through the internal credit rating channel. Our approach goes towards an identification through heterogeneity (Buch and Goldberg, 2014) by using important methodological contributions that include the control of firm-level unobserved characteristics comprising firm fixed effects (Khwaja and Mian, 2008; Schnabl, 2012), and the control of firm–time unobserved heterogeneity by using firm–time fixed effects (Jimenez et. al., 2011; Bofondi et. al, 2013; Popov and van Horen, 2013).

Finally, the results of this paper raise important concerns about the potential triggering of a systemic downgrading of credit ratings given certain local conditions. Thanks to the characteristics of the Brazilian credit registry (*i.e.*, a bank does not have access to the credit rating assigned by another bank), the downgrade of credit ratings is not apt to become systemic. In other words, Brazil may have a comparative advantage over those economies in which information on credit ratings is publicly available. An increase of pessimism (in this case from foreign banks) towards the

creditworthiness of a particular borrower will not directly cause other lenders to add to the financial distress of the borrower (Hertzberg, Liberti and Paravisini, 2011).

References

Agarwal, S., and R. Hauswald (2010) "Distance and Private Information in Lending", *Review of Financial Studies* 23: 2757-2788.

Albertazzi, U. and D. Marchetti (2010) "Credit Supply, Flight to Quality and Evergreening", Bank of Italy Working Paper No. 756.

BCBS (2013) "Regulatory Consistency Assessment Program in Brazil", Basel Committee on Banking Supervision.

Berger, A., and R. DeYoung (2006) "Technological Progress and the Geographic Expansion of Commercial Banks," *Journal of Money, Credit, and Banking*, 38: 1483-1513.

Berrospide, J., L. Black, and W. Keeton (2013) "The cross-market spillover of economic shocks through multi-market banks", Finance and Economics Discussion Series, No. 52.

Bertrand M., E. Duflo, and S. Mullainathan (2004) "How Much Should We Trust Differences-in-Differences Estimates?", *Quarterly Journal of Economics*, 119: 249-275.

BIS (1999) "Principles for the Management of credit risk", Basel Committee on Banking Supervision.

Bofondi, M., L. Carpinelli, and E. Sette. (2013) "Credit Supply During a Sovereign Crisis", Bank of Italy Working Paper No. 909.

Bouwman, C. (2009) "Bank Capital, Monitoring and Bank Performance", Case Western Reserve University and Wharton Financial Institutions Center.

Buch, C., and Goldberg, L. (2014) "International Banking and Liquidity Risk Transmission: Lessons from Across Countries", Federal Reserve Bank of New York Staff Report No. 675.

Canales, R., and R. Nanda (2012) "A Darker Side to Decentralized Banks: Market Power and Credit Rationing in SME Lending," *Journal of Financial Economics*, 105: 353-366.

Carey, M. and M. Hrycay (2001) "Parameterizing Credit Risk Models With Rating Data", *Journal of Banking and Finance* 25: 195-270.

Carey, M. (2002) "Some Evidence on the Consistency of Banks' Internal Credit Ratings", in Michael Ong, ed., Credit Ratings: Methodologies, Rationale and Default Risk. London: Risk Books.

Cantor, R. (2004) "An Introduction to Recent Research on Credit Ratings", *Journal of Banking & Finance* 28: 2565-2573.

Central Bank of Brazil, Financial Stability Reports, various years.

Cetorelli, N., L. Goldberg (2012) "Follow the Money: Quantifying Domestic Effects of Foreign Bank Shocks in the Great Recession", *American Economic Review* 102: 213-18.

Chen, Q. and W. Jiang (2006) "Analysts' Weighting of Private and Public Information", *Review of Financial Studies* 19: 319-355.

Coleman, N., and L. Feler (2014) "Bank Ownership, Lending, and Local Economic Performance during the 2008-2010 Financial Crisis", *International Finance Discussion Papers* No. 1099.

Da Silva, L., and R. Harris (2012) "Sailing through the Global Financial Storm: Brazil's recent experience with monetary and macroprudential policies to lean against the financial cycle and deal with systemic risks", Central Bank of Brazil working paper series No. 290.

Das, S., D. Du¢e, N. Kapadia, and L. Saita (2007) "Common Failings: How Corporate Defaults are Correlated", *Journal of Finance* 62: 93-118.

De Haas, R., and N. Van Horen (2012) "International Shock Transmission after the Lehman Brothers Collapse: Evidence from Syndicated Lending", *American Economic Review* 102: 231-237.

Dell'Ariccia, G., and R. Marquez (2006) "Competition Among Regulators and Credit Market Integration", *Journal of Financial Economics* 79: 401-430.

Detragiache, E., P. Garella and L. Guiso (2000) "Multiple versus Single Banking Relationships: Theory and Evidence", *Journal of Finance* 55: 1133-1161.

Diamond, D. (1984) "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies* 51: 393-414.

Diamond, D. (1991) "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt", *Journal of Political Economy*, 99: 689-721.

Fama, E. (1985) "What's Different About Banks?" *Journal of Monetary Economics* 15: 29-39.

Granger, C. (1969) "Investigating Causal Relations by Econometric Models and Cross-spectral Methods", *Econometrica* 37: 424–438.

Hausman, J. (1978) "Specification Tests in Econometrics", *Econometrica* 46: 1251–1271.

Hertzberg, A., J. Liberti, and D. Paravisini (2010) "Information and Incentives Inside the Firm: Evidence from Loan Officer Rotation", *Journal of Finance* 65: 795–828.

Hertzberg, A., J. Liberti, and D. Paravisini (2011) "Public information and coordination: evidence from a credit registry expansion," *The Journal of Finance* 66: 379-412.

IMF (2012) "Brazil: Financial System Stability Assessment", International Monetary Fund, Country Report No. 12/206.

Jiménez, G., S. Ongena, J. Peydró, and J. Saurina (2012) "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications", *American Economic Review* 102: 2301-26.

Kempf, E., A. Manconi, and O. Spalt (2014) "Distracted Shareholders and Corporate Actions" Tilburg University CentER working paper

Keys, B., K. Tanmoy, A. Seru, and V. Vig (2009) "Financial Regulation and Securitization: Evidence from Subprime Mortgage Loans", *Journal of Monetary Economics* 56: 700-720.

Keynes, J. (1937) "The General Theory of Employment", *Quarterly Journal of Economics* 51: 209-23.

Khwaja, A., and A. Mian (2008) "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market", *American Economic Review* 98: 1413-1442.

Knight, F. (1921) "Risk, Uncertainty, and Profit", New York: Houghton Mifflin.

Laeven, L. and F. Valencia (2012) "Systemic Banking Crises Database: An Update", International Monetary Fund Working Paper No 163.

Lawson, T. (1985) "Uncertainty and Economic Analysis", *Economic Journal* 95: 909-27.

Mian, A. (2006) "Distance Constraints: The Limits of Foreign Lending in Poor Economies," *Journal of Finance,* 61: 1465-1505.

Nakamura, L., and K. Roszbach (2010) "Credit Ratings and Bank Monitoring Ability" Discussion Paper 2010-37S, Tilburg University, Center for Economic Research.

Nelson S. and P. Katzenstein (2014) "Uncertainty, Risk, and the Financial Crisis of 2008", *International Organization* 68: 361-392.

Norden, L., and M. Weber (2010) "Credit Line Usage, Checking Account Activity, and Default Risk of Bank Borrowers", *Review of Financial Studies* 23: 3665-3699.

Padilla, J. and M. Pagano (2000) "Sharing Default Information as a Borrower Discipline Device", *European Economic Review* 44: 1951–1980.

Petersen, M., and R. Rajan (1994) "The Benefits of Firm-Creditor Relationships: Evidence from small-business data", *Journal of Finance* 49: 3-37.

Petersen, M. (2009) "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches", *Review of Financial Studies* 22: 435-480.

Ramakrishnan R., and A. Thakor (1984) "Information Reliability and a Theory of Financial Intermediation" *Review of Economic Studies* 51: 415-432.

Schechtman, R., V.Garcia, S. Koyama, and G. Parente (2004) "Credit Risk Measurement and the Regulation of Bank Capital and Provision Requirements in Brazil-A Corporate Analysis," Central Bank of Brazil Working Paper 91.

Schnabl, P. (2012) "The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market", *Journal of Finance* 67: 897-932.

Stein, J. (2002) "Information Production and Capital Allocation: Decentralized vs. Hierarchical Firms", *Journal of Finance* 57: 1891-1921.

Van Ricjkeghem, C., and B. Weder (2003), "Spillovers through Banking Centers: A Panel Data Analysis of Bank Flows," *Journal of International Money and Finance*, 22: 483-509.

Widmaier, W., M. Blyth, and L. Seabrooke (2007) “Exogenous Shocks or Endogenous Constructions? The Meanings of Wars and Crises”, *International Studies Quarterly* 51: 747-59.

Figure 1: Provision of total due amount – *Restricted sample*

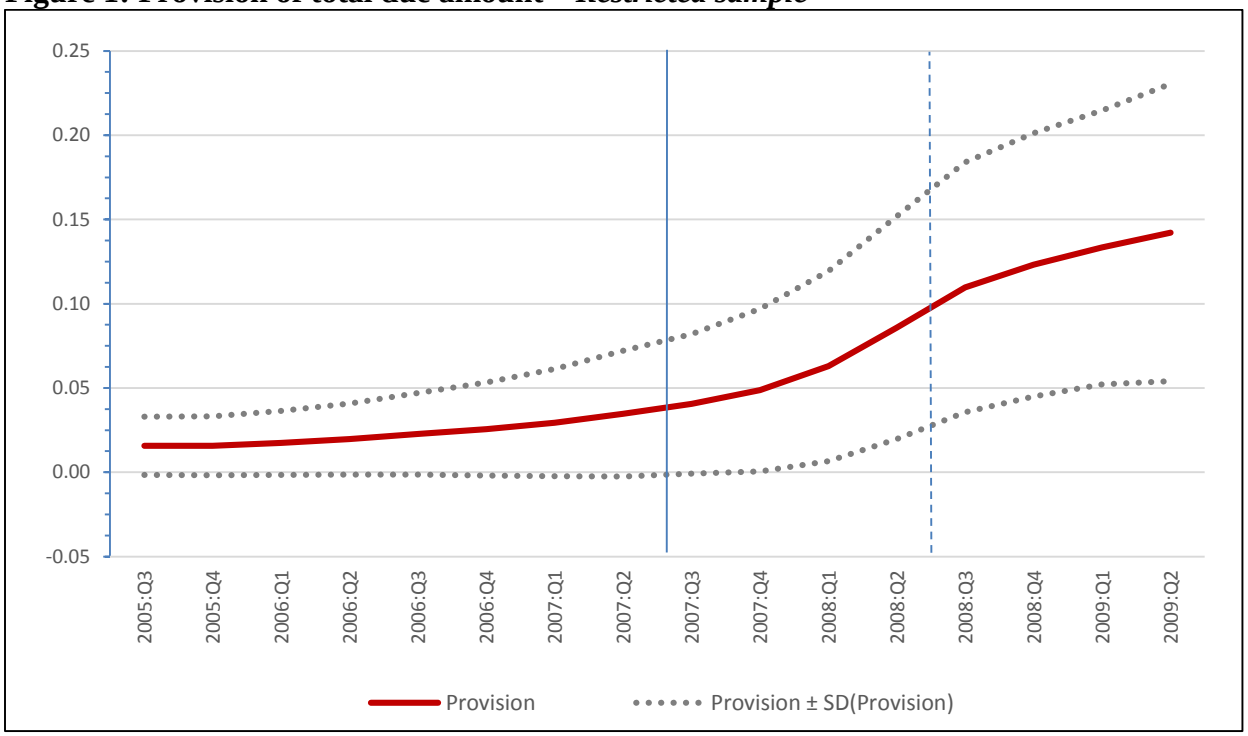


Figure 2: Risk assessment by bank ownership – *Restricted sample*

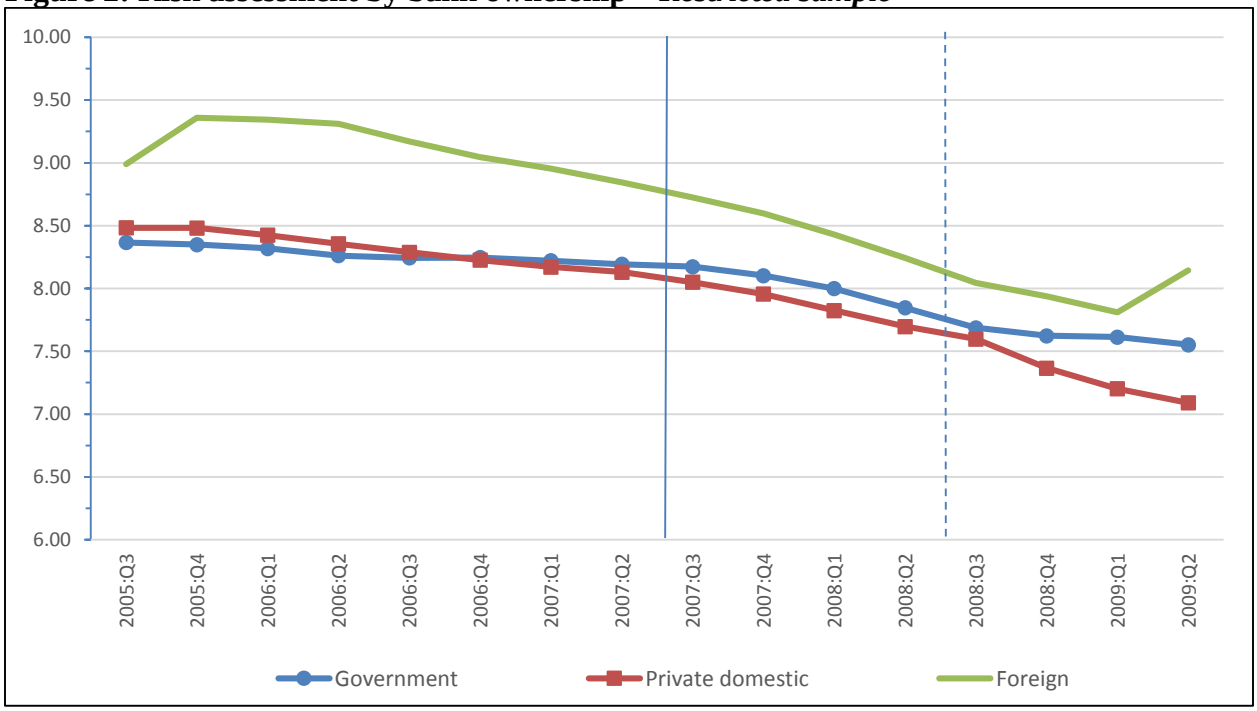


Figure 3: Provision by bank ownership – *Restricted sample*

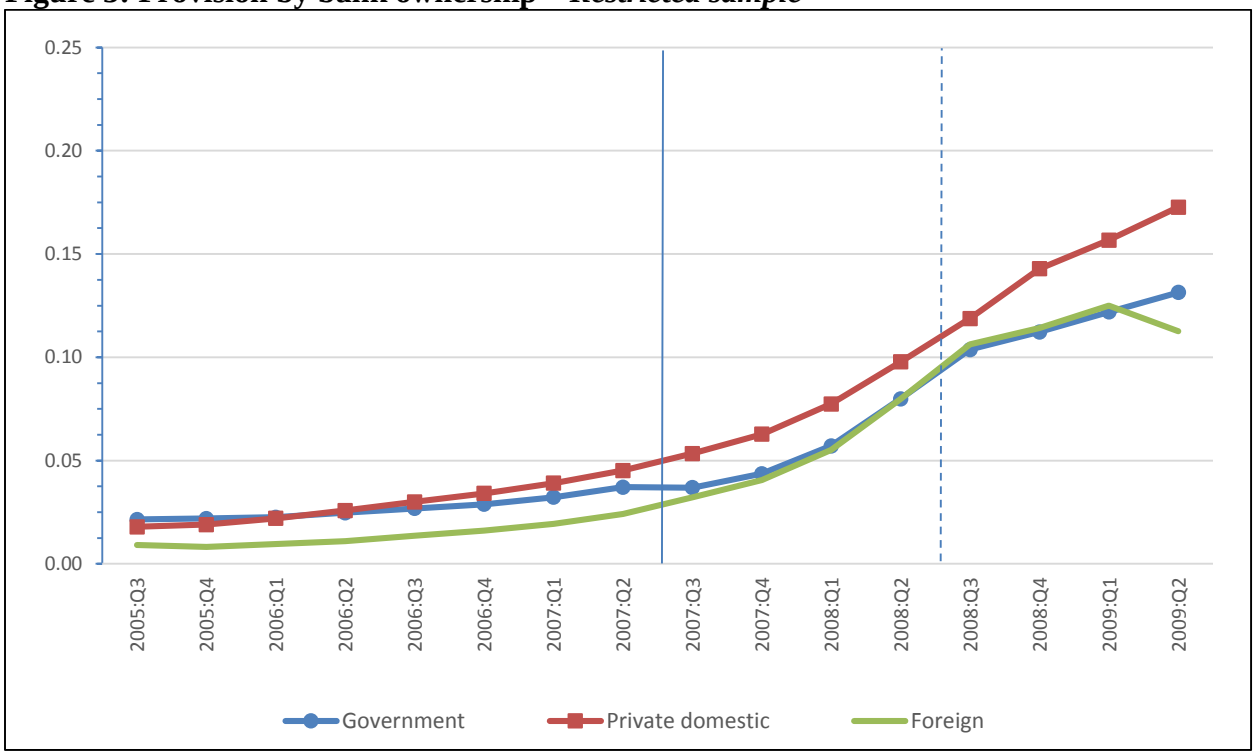


Table 1
Credit rating scheme

All banks employ the same definition of default, given by the Resolution 2.682/1999 of Central Bank of Brazil. Ratings go from "AA" (highest quality), "A" (low probability of default) to "H" (very high probability of loss). Each rating level is associated with a percentage provision of the total due amount of the loan. In the case of days overdue, the rating in the column represents the upper bound for each loan operation (*e.g.*: a loan with 92 days overdue will be classified at most at rating "E"). Credit ratings must be reviewed monthly in case of late payments.

Credit rating	AA	A	B	C	D	E	F	G	H
Numerical correspondent value for *Risk assessment*	10	9	8	7	6	5	4	3	2
Provision (%) of total due amount	0	0.5	1	3	10	30	50	70	100
Days overdue	0	0	15-30	31-60	61-90	91-120	121-150	151-180	>180

Table 2
Variables definitions

The table presents the definition of variables used in the paper. We use credit registry data, bank ownership data and quarterly accounting information provided by Central Bank of Brazil. Additionally, we use data from Laeven and Valencia (2012) and Laeven and Valencia bank failure dataset.

Variable name	Definition
Risk assessment	Weighted credit rating of all loans assigned by bank *b* to borrower *i* at quarter *t*, according to Resolution 2.682/1999 of the Central Bank of Brazil
Risk provision	Ratio of total due amount provisioned by bank *b* to borrower *i* at quarter *t*, according to Resolution 2.682/1999 of the Central Bank of Brazil
Foreign	Dummy variable that takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise
Affected	Dummy variable that takes the value one if the parent of the foreign bank in Brazil is from any country where the financial crisis started in 2007 or 2008 (using Laeven and Valencia (2012)), and zero otherwise
Affected & assisted	Dummy variable that takes the value one if the parent of the foreign bank in Brazil received assistance in its home country (using Laeven and Valencia bank failure dataset), and zero otherwise
Government	Dummy variable that takes the value one if bank is public, and zero otherwise
Post	Dummy variable that takes the value one from 2007:Q3 to 2009:Q2, and zero otherwise
Amount	Log of outstanding loan amount of borrower *i* at bank *b* in quarter *t*, winsorized on 98%/2% level
Collateral	Ratio of total loan amount guaranteed by any type of collateral to Amount
Oldest	Dummy variable that takes the value of one if bank is the one with whom the firm has the longest relationship
Overdraft	Ratio of amount that is classified as overdraft
Factoring	Ratio of amount that is classified as factoring
Term loans	Ratio of amount that is classified as term loans
Leasing	Ratio of amount that is classified as leasing
Export loan	Ratio of amount that is classified as export loans
Size	Log of total assets of the bank, adjusted by official inflation index, winsorized on 98%/2% level
Credit assets	Ratio of credit assets to Size, winsorized on 98%/2% level
Equity	Ratio of equity to Size, winsorized on 98%/2% level
Roa	Quarterly return over assets * 100, winsorized on 98%/2% level

Table 3
Descriptive statistics

This table presents descriptive statistics of the variables used in the paper for the full and for the restrictive sample of firms. The t-test is used to test whether the mean of the pre-period is the same as the mean of the post-period.

Variable name	N	Mean	Median	St. dev.	Min	Max	Mean		
							Before	Diff.	T-Test (p-value)
Panel A: Full sample									
Risk assessment	9,708,695	7.83	8.16	2.00	2.00	10.00	8.10	−0.53	0.00
Risk provision	9,708,695	0.10	0.01	0.27	0.00	1.00	0.07	0.07	0.00
Foreign	9,708,695	0.11	0	0.32	0	1	0.12	−0.00	0.00
Government	9,708,695	0.43	0	0.49	0	1	0.42	0.01	0.00
Post	9,708,695	0.51	1	0.50	0	1	-	-	-
Size	9,708,695	26.04	26.50	0.97	17.63	26.50	25.93	0.21	0.00
Credit assets	9,708,695	0.28	0.29	0.09	0.00	0.81	0.29	−0.01	0.00
Equity	9,708,695	0.08	0.07	0.04	0.03	0.97	0.08	−0.01	0.00
Roa	9,708,695	0.33	0.32	0.30	−4.06	4.75	0.37	−0.08	0.00
Amount	9,708,695	10.66	10.55	1.51	7.17	14.47	10.51	0.29	0.00
Collateral	9,708,695	0.22	0.00	0.37	0.00	1.00	0.21	0.01	0.00
Oldest	9,708,695	0.67	1	0.46	0	1	0.67	0.02	0.00
Overdraft	9,708,695	0.46	0.37	0.40	0.00	1.00	0.52	−0.12	0.00
Factoring	9,708,695	0.13	0.00	0.26	0.00	1.00	0.15	−0.05	0.00
Term loans	9,708,695	0.05	0.00	0.19	0.00	1.00	0.05	−0.00	0.00
Leasing	9,708,695	0.00	0.00	0.04	0.00	1.00	0.00	0.00	0.00
Export loan	9,708,695	0.00	0.00	0.06	0.00	1.00	0.00	−0.00	0.00
Panel B: Restricted sample									
Risk assessment	1,497,217	8.27	8.88	1.66	2.00	10.00	8.61	−0.69	0.00
Risk provision	1,497,217	0.06	0.01	0.19	0.00	1.00	0.02	0.06	0.00
Foreign	1,497,217	0.38	0	0.49	0	1	0.38	−0.00	0.00
Affected	1,497,217	0.37	0	0.49	0	1	0.37	−0.00	0.00
Assisted	1,497,217	0.19	0	0.39	0	1	0.20	−0.01	0.00
Government	1,497,217	0.29	0	0.45	0	1	0.28	0.01	0.00
Post	1,497,217	0.50	0	0.50	0	1	-	-	-
Size	1,497,217	25.75	26.12	1.06	17.63	26.50	25.59	0.33	0.00
Credit assets	1,497,217	0.29	0.29	0.09	0.00	0.81	0.30	−0.02	0.00
Equity	1,497,217	0.08	0.07	0.04	0.03	0.97	0.08	−0.01	0.00
Roa	1,497,217	0.29	0.28	0.31	−4.06	4.75	0.32	−0.06	0.00
Amount	1,497,217	11.69	11.58	1.58	8.75	15.75	11.57	0.24	0.00
Collateral	1,497,217	0.24	0.00	0.36	0.00	1.00	0.26	−0.04	0.00
Oldest	1,497,217	0.34	0	0.47	0	1	0.34	0.00	0.09
Overdraft	1,497,217	0.40	0.30	0.36	0.00	1.00	0.44	−0.09	0.00
Factoring	1,497,217	0.12	0.00	0.25	0.00	1.00	0.14	−0.05	0.00
Term loans	1,497,217	0.06	0.00	0.20	0.00	1.00	0.06	−0.01	0.00
Leasing	1,497,217	0.00	0.00	0.05	0.00	1.00	0.00	0.00	0.00
Export loan	1,497,217	0.02	0.00	0.11	0.00	1.00	0.02	−0.00	0.04

Table 4
Descriptive statistics

This table presents the variables used for each group of banks. We show the mean in the pre-period and the additional difference after the crisis. The t-test is used to test whether the mean of the pre-period (Post=0) is the same as the mean of the post-period (Post=1).

	Foreign banks			*Government banks*			*Domestic banks*		
Variable name	Before	Diff.	T-Test (p-value)	Before	Diff.	T-test (p-value)	Before	Diff.	T-Test (p-value)
Panel A: Full sample									
Risk assessment	9.11	−0.81	0.00	8.14	−0.27	0.00	7.81	−0.69	0.00
Risk provision	0.02	0.06	0.00	0.03	0.04	0.00	0.11	0.09	0.00
Size	25.20	0.53	0.00	26.18	0.06	0.00	25.92	0.27	0.00
Credit assets	0.33	−0.06	0.00	0.31	0.04	0.00	0.26	−0.04	0.00
Equity	0.09	−0.02	0.00	0.07	−0.00	0.00	0.09	−0.01	0.00
Roa	0.25	−0.03	0.00	0.37	−0.04	0.00	0.41	−0.13	0.00
Amount	11.26	0.13	0.00	10.06	0.48	0.00	10.74	0.16	0.00
Collateral	0.25	−0.10	0.00	0.09	−0.05	0.00	0.32	0.10	0.00
Oldest	0.57	0.01	0.00	0.69	0.01	0.00	0.67	0.03	0.00
Overdraft	0.41	−0.06	0.00	0.53	−0.24	0.00	0.55	−0.03	0.00
Factoring	0.04	−0.02	0.00	0.20	−0.06	0.00	0.13	−0.04	0.00
Term loans	0.07	−0.02	0.00	0.01	0.01	0.00	0.08	−0.02	0.00
Leasing	0.01	−0.00	0.01	0.00	0.00	0.06	0.00	0.00	0.00
Export loan	0.01	0.00	0.00	0.00	−0.00	0.00	0.00	−0.00	0.00
N. of observations			1,113,509			4,128,327			4,466,859
Panel B: Restricted sample									
Risk assessment	9.13	−0.87	0.00	8.27	−0.44	0.00	8.31	−0.69	0.00
Risk provision	0.01	0.07	0.00	0.03	0.06	0.00	0.03	0.08	0.00
Size	25.18	0.55	0.00	26.13	0.07	0.00	25.61	0.29	0.00
Credit assets	0.34	−0.06	0.00	0.30	0.04	0.00	0.27	−0.03	0.00
Equity	0.09	−0.02	0.00	0.06	−0.00	0.00	0.09	−0.01	0.00
Roa	0.24	−0.03	0.00	0.36	−0.05	0.00	0.39	−0.13	0.00
Amount	11.65	0.19	0.00	11.10	0.36	0.00	11.89	0.20	0.00
Collateral	0.27	−0.11	0.00	0.12	−0.05	0.00	0.37	0.05	0.00
Oldest	0.34	−0.00	0.25	0.35	−0.01	0.00	0.32	0.01	0.00
Overdraft	0.39	−0.05	0.00	0.47	−0.19	0.00	0.48	−0.05	0.00
Factoring	0.05	−0.02	0.00	0.24	−0.07	0.00	0.17	−0.05	0.00
Term loans	0.08	−0.03	0.00	0.02	0.02	0.00	0.08	−0.01	0.00
Leasing	0.01	−0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00
Export loan	0.01	0.00	0.00	0.02	−0.01	0.08	0.02	−0.00	0.00
N. of observations			572,102			426,853			498,262

Table 5
Empirical Strategy

This table introduces the basic empirical strategy. "Before" refers to quarters from 2005:Q3 to 2007:Q2 and "after" refers to quarters from 2007:Q3 to 2009:Q2. We next collapse the data into single data point (based on averages) both before and after. This results in two data points per unit of observation, one data point for the pre-period and one point for the post-period. "Difference" column stands for the difference between "Before" and "After". Standard errors are reported in parentheses. ***, **, * implies significance at 99% level, 95% level, and 90% level, respectively. The data spans the quarters of 2005:Q3 to 2009Q2.

	Before	After	Difference	N
Panel A1: Risk assessment - Full sample				
Foreign banks	9.1221	8.2456	−0.8765***	158,006
	(0.0030)	(0.0062)	(0.0069)	
Government banks	8.1320	7.8228	−0.3092***	565,032
	(0.0018)	(0.0028)	(0.0033)	
Private domestic banks	7.8525	7.1622	−0.6902***	607,686
	(0.0035)	(0.0043)	(0.0056)	
Difference (Foreign–Domestic)			−0.3660***	
			(0.0057)	
Panel A2: Risk provision - Full sample				
Foreign banks	0.0188	0.0886	0.0699***	158,006
	(0.0002)	(0.0007)	(0.0007)	
Government banks	0.0326	0.0830	0.0504***	565,032
	(0.0002)	(0.0004)	(0.0004)	
Private domestic banks	0.1046	0.1902	0.0857***	607,686
	(0.0005)	(0.0006)	(0.0008)	
Difference (Foreign–Domestic)			0.0008	
			(0.0007)	
Panel B1: Risk assessment - Restricted sample				
Foreign banks	9.1343	8.2104	−0.9239***	80,144
	(0.0040)	(0.0083)	(0.0092)	
Government banks	8.2575	7.7775	−0.4800***	56,908
	(0.0056)	(0.0090)	(0.0106)	
Private domestic banks	8.3301	7.6422	−0.6879***	67,595
	(0.0057)	(0.0095)	(0.0111)	
Difference (Foreign–Domestic)			−0.3300***	
			(0.0091)	
Panel B2: Risk provision - Restricted sample				
Foreign banks	0.0138	0.08461	0.0709***	80,144
	(0.0003)	(0.0009)	(0.0010)	
Government banks	0.0275	0.0911	0.0636***	56,908
	(0.0004)	(0.0011)	(0.0012)	
Private domestic banks	0.0291	0.1078	0.0787***	67,595
	(0.0005)	(0.0012)	(0.0013)	
Difference (Foreign–Domestic)			0.0009	
			(0.0011)	

Table 6
Effect of bank ownership on *Risk assessment*

This table shows the impact of foreign ownership on bank–firm risk relationship. The dependent variable is *Risk assessment*. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant, and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.3532***	−0.3442***	−0.3330***	−0.2457**	−0.2470***	−0.2606***
	(0.0877)	(0.0467)	(0.0464)	(0.1148)	(0.0585)	(0.0557)
Government * Post				0.2332*	0.2040***	0.2164***
				(0.1177)	(0.0583)	(0.0545)
Bank controls						
Size			−0.0988*			−0.0872
			(0.0590)			(0.0532)
Credit assets			0.6600**			0.1903
			(0.2511)			(0.2274)
Equity			−1.6352**			−1.6003***
			(0.6276)			(0.5790)
Roa			0.0119			0.0053
			(0.0196)			(0.0206)
Relationship controls						
Amount			0.0568**			0.0560**
			(0.0231)			(0.0227)
Collateral			−0.0172			−0.0052
			(0.0306)			(0.0305)
Oldest			−0.0218			−0.0216
			(0.0220)			(0.0218)
Type of loan						
Overdraft			0.1433*			0.1553*
			(0.0799)			(0.0812)
Factoring			0.7732***			0.7853***
			(0.0768)			(0.0775)
Term loans			−0.0340			−0.0340
			(0.2029)			(0.2052)
Leasing			0.1148			0.1203
			(0.1022)			(0.1030)
Export loans			−0.1606			−0.1554
			(0.1050)			(0.1045)
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217
R-squared	0.20	0.22	0.24	0.20	0.22	0.24

Table 7
Effect of bank ownership on *Risk provision*

This table shows the impact of foreign ownership on bank−firm risk relationship. The dependent variable is *Risk provision*. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	0.0020	0.0008	−0.0047	−0.0069	−0.0057	−0.0088
	(0.0153)	(0.0085)	(0.0096)	(0.0197)	(0.0112)	(0.0116)
Government * Post				-0.0195	−0.0136	−0.0123
				(0.0203)	(0.0094)	(0.0085)
Bank controls						
Size			0.0148**			0.0142**
			(0.0061)			(0.0058)
Credit assets			−0.0494**			−0.0227
			(0.0242)			(0.0197)
Equity			0.1100**			0.1081**
			(0.0437)			(0.0411)
Roa			−0.0026			−0.0022
			(0.0019)			(0.0019)
Relationship controls						
Amount			0.0018			0.0018
			(0.0028)			(0.0028)
Collateral			−0.0075*			−0.0082*
			(0.0041)			(0.0042)
Oldest			0.0037			0.0037
			(0.0027)			(0.0027)
Type of loan						
Overdraft			−0.0013			−0.0020
			(0.0087)			(0.0089)
Factoring			−0.0240***			−0.0247***
			(0.0046)			(0.0049)
Term loans			0.0306			0.0306
			(0.0263)			(0.0264)
Leasing			0.0032			0.0029
			(0.0126)			(0.0127)
Export loans			−0.0006			−0.0009
			(0.0062)			(0.0063)
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217
R-squared	0.10	0.04	0.05	0.10	0.04	0.05

Table 8
Exposure measure – Affected countries

This table shows two tests on the impact of a group of foreign banks on credit rating measures. Using Laeven and Valencia (2012), we distinguish foreign banks where the parent is from any country where the financial crisis started in 2007 or 2008 (variable *Affected*). In columns (1) to (3), our dependent variable is *Risk assessment*. In columns (4) to (6), our dependent variable is *Risk provision*. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Risk assessment			*Risk provision*		
	(1)	(2)	(3)	(4)	(5)	(6)
Affected * Post	−0.9337***	−0.4988***	−0.5525***	0.0503***	0.0124	0.0125
	(0.1009)	(0.0703)	(0.0892)	(0.0138)	(0.0080)	(0.0081)
Foreign * Post	0.6822***	0.2475***	0.2866***	−0.0569***	−0.0179*	−0.0212**
	(0.1454)	(0.0776)	(0.0959)	(0.0196)	(0.0094)	(0.0087)
Government * Post	0.2332*	0.2023***	0.2152***	−0.0195	−0.0135	−0.0123
	(0.1177)	(0.0581)	(0.0543)	(0.0203)	(0.0094)	(0.0085)
Bank controls	No	No	Yes	No	No	Yes
Relationship controls	No	No	Yes	No	No	Yes
Type of loan	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217
R-squared	0.21	0.22	0.24	0.10	0.04	0.05

Table 9
Exposure measures – Affected & assisted banks

This table shows two tests on the impact of a group of foreign banks on credit rating measures. Using Laeven and Valencia bank failure dataset, we also distinguish foreign banks where the parent received assistance in its home country (variable *Affected & assisted*). In columns (1) to (3), our dependent variable is *Risk assessment*. In columns (4) to (6), our dependent variable is *Risk provision*. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Risk assessment			*Risk provision*		
	(1)	(2)	(3)	(4)	(5)	(6)
Affected & assisted * Post	0.0561	0.0587	0.0064	0.0274***	0.0281***	0.0344***
	(0.0545)	(0.0444)	(0.0523)	(0.0034)	(0.0049)	(0.0054)
Affected * Post	−0.9618***	−0.5291***	−0.5555***	0.0365***	−0.0022	−0.0037
	(0.1053)	(0.0808)	(0.1019)	(0.0097)	(0.0074)	(0.0072)
Foreign * Post	0.6821***	0.2469***	0.2862***	−0.0569***	−0.0182*	−0.0231**
	(0.1454)	(0.0774)	(0.0953)	(0.0196)	(0.0096)	(0.0091)
Government * Post	0.2331*	0.2001***	0.2145***	−0.0195	−0.0146	−0.0158*
	(0.1177)	(0.0582)	(0.0566)	(0.0203)	(0.0096)	(0.0085)
Bank controls	No	No	Yes	No	No	Yes
Relationship controls	No	No	Yes	No	No	Yes
Type of loan	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217
R-squared	0.21	0.22	0.24	0.10	0.05	0.05

Table 10
Placebo experiment

This table shows the impact of foreign ownership on bank–firm risk relationship when conducting a placebo test with a sample period before August 2007. In columns (1) to (3), our dependent variable is *Risk assessment*. In columns (4) to (6), our dependent variable is *Risk provision*. In specifications (1) to (6), the sample period goes from 2003:Q4 to 2007:Q2, where *Post* is a dummy variable that takes the value one starting from 2005:Q3. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Risk assessment			*Risk provision*		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	0.2420***	−0.1026	0.0492	−0.0310***	−0.0039	−0.0053
	(0.0647)	(0.0729)	(0.0641)	(0.0084)	(0.0057)	(0.0055)
Government * Post	0.0176	0.0047	−0.0758	−0.0006	−0.0009	0.0061
	(0.1355)	(0.0963)	(0.0791)	(0.0097)	(0.0060)	(0.0046)
Bank controls	No	No	Yes	No	No	Yes
Relationship controls	No	No	Yes	No	No	Yes
Type of loan	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,278,584	1,278,584	1,278,584	1,278,584	1,278,584	1,278,584
R-squared	0.19	0.23	0.25	0.10	0.04	0.04

Table 11
Effect of bank ownership on *Lending*

This table shows the impact of foreign ownership on credit supply. The dependent variable is *Amount*. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.0814	−0.0802	−0.0139	−0.0080	−0.0317	0.0136
	(0.1346)	(0.0922)	(0.0886)	(0.1281)	(0.0973)	(0.1066)
Government * Post				0.1590	0.1017	0.0828
				(0.1205)	(0.0776)	(0.0774)
Bank controls	No	No	Yes	No	No	Yes
Relationship controls	No	No	Yes	No	No	Yes
Type of loan	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217	1,497,217
R-squared	0.08	0.07	0.18	0.08	0.07	0.18

Table 12
Composition effect hypothesis

This table shows the impact of foreign ownership on bank–firm risk relationship after controlling for the composition effect hypothesis. The dependent variable is *Risk assessment*. Specifications (1) to (6) account for firms with three or more bank relationships, where the firm must have a relationship with a foreign, with a private domestic, and with a public bank in the pre- and post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.3933***	−0.3889***	−0.3623***	−0.3269***	−0.3094***	−0.3125***
	(0.0971)	(0.0620)	(0.0522)	(0.1133)	(0.0674)	(0.0551)
Government * Post				0.1475	0.1725***	0.1823***
				(0.0919)	(0.0500)	(0.0527)
Bank controls	No	No	Yes	No	No	Yes
Relationship controls	No	No	Yes	No	No	Yes
Type of loan	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	614,648	614,648	614,648	614,648	614,648	614,648
R-squared	0.19	0.18	0.21	0.19	0.18	0.21

Table 13
Sample periods

This table shows two robustness tests on the impact of foreign ownership on bank–firm risk relationship. The dependent variable is *Risk assessment*. In column (1) to (3), we restrict the sample period from 2006:Q3 to 2008:Q2, instead of 2005:Q3 to 2009:Q2, in order to focus the analysis after tensions in the European interbank market in August 2007. *Post* is a dummy variable that takes the value one starting from 2007:Q3. In column (4) to (6), we restrict the sample period from 2007:Q3 to 2009:Q2, where *Post* is a dummy variable that takes the value one starting from 2008:Q3, in order to focus the analysis after the crisis in the US. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and post-period. All regressions include bank fixed effects. In addition, column (1) and (4) include time and firm fixed effects, and the other columns include firmXtime fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Sample period 2006:Q3 to 2008:Q2 Post starts in 2007:Q3			Sample period 2007:Q3 to 2009:Q2 Post starts in 2008:Q3		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.1837**	−0.1781***	−0.1728***	−0.1435	−0.1415**	−0.1650***
	(0.0703)	(0.0472)	(0.0376)	(0.1135)	(0.0620)	(0.0539)
Government * Post	0.1301**	0.1228***	0.1241***	0.0575	0.0781	0.0580
	(0.0600)	(0.0355)	(0.0316)	(0.1123)	(0.0648)	(0.0597)
Bank controls	No	No	Yes	No	No	Yes
Relationship controls	No	No	Yes	No	No	Yes
Type of loans	No	No	Yes	No	No	Yes
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	No	No	Yes	No	No
Firm	Yes	No	No	Yes	No	No
Firm-by-time	No	Yes	Yes	No	Yes	Yes
Observations	759,668	759,668	759,668	662,942	662,942	662,942
R-squared	0.19	0.22	0.25	0.15	0.15	0.17

Appendix Table 1
List of foreign banks

This table shows all the foreign investors present in the sample, their country and their average total assets for the pre- and post-period. Using Laeven and Valencia (2012), we show whether the foreign investor is included in the group of countries where the international crisis started in 2007 and 2008 (column Start 2007-2008). We also show whether the bank received assistance back home in 2008 and 2009, using Laeven and Valencia bank failure dataset.

Foreign investor	Country of investor	Total assets (2005:Q3–2007:Q2)	Total assets (2007:Q3–2009:Q2)	% change	Foreign	Start 2007–2008	Assistance
B. Nacion Argentina	Argentina	93	99	0.06	1	0	0
B. Provincia de Buenos Aires	Argentina	155	165	0.06	1	0	0
Marsau Uruguay Holdings	Bahrain	4,500	6,830	0.52	1	0	0
Merk	Bermuda	148	215	0.45	1	0	0
Bnp Paribas	France	20,300	30,500	0.50	1	1	1
Credit Agricole	France	825	1,550	0.88	1	1	1
Societe Generale	France	2,090	6,490	2.11	1	1	1
Deutsche Bank	Germany	9,630	17,500	0.82	1	1	0
WestLB	Germany	3,230	4,180	0.29	1	1	1
Sumitomo Mitsui	Japan	1,250	1,410	0.13	1	0	0
Tokyo-Mitsubishi	Japan	1,540	2,280	0.48	1	0	0
Morelia	Luxemburg	5,140	6,100	0.19	1	1	0
ABN AMRO	Netherlands	178,000	200,000	0.12	1	1	1
Rabobank	Netherlands	5,680	7,610	0.34	1	1	0
BPN	Portugal	320	481	0.50	1	1	1
Banif	Portugal	1,760	1,890	0.07	1	1	0
Korea Development Bank	South Korea	779	1,480	0.90	1	0	0
Korea Exchange Bank	South Korea	83	162	0.95	1	0	0
Santander	Spain	132,000	202,000	0.53	1	1	0
UBS	Switzerland	26,500	21,400	(0.19)	1	1	1
Barclays	UK	2,600	6,010	1.31	1	1	0
HSBC	UK	81,200	112,000	0.38	1	1	0
Nuevo Banco Comercial	Uruguay	226	271	0.20	1	0	0
Brascan	US	1,220	1,100	(0.10)	1	1	0
Cargil	US	307	554	0.80	1	1	0
Citibank	US	51,800	49,800	(0.04)	1	1	1
Deere & Company	US	2,050	2,150	0.05	1	1	0
JP Morgan	US	12,400	14,100	0.14	1	1	0
Total assets		**547,776**	**698,327**	**0.27**			

Appendix Table 2
List of foreign banks that received assistance in their country of origin

This table shows all the foreign investors present in the sample that received assistance in the post-period with further details on the type and main features of the intervention/resolution. Data is from Laeven and Valencia bank failure dataset.

Name of parent bank	Country	Date of Intervention	Type and main features of Intervention / Resolution
BNP Paribas	France	20-Oct-08	On October 20th, 2008, the French government announced it would invest €10.5 billion of capital in the form of hybrid-subordinated debt in six of the largest banks. This was part of the €40 billion fund available for bank recapitalization. A total of 2.25 billion capital funds were made available for BNP Paribas. On March 31st, 2009, Société de Prise de Participation de l'Etat (SPPE), a French banking plan, purchased €5.1 bn of non-voting shares in BNP Paribas. These shares do not bear any voting right and are not convertible into ordinary shares.
Credit Agricole	France	20-Oct-08	French government announced it would invest €10.5 billion of capital in the form of hybrid-subordinated debt in six of the largest banks. This was part of the €40 billion fund available for bank recapitalization. 3 billion for Credit Agricole.
Societe Generale	France	20-Oct-08	The French government announced it would invest €10.5 billion of capital in form of hybrid-subordinated debt in six of the largest banks. This was part of the € 40billion fund available for bank recapitalization. 1.7 billion for Société Générale.
West LB	Germany	8-Feb-08	Emergency funding through the State of North Rhine Westphalia and the savings banks, majority owners. Savings banks' association extended guarantees for €3bln. Merger discussions.
ABN Amro Bank N.V.	Netherlands	29-Sep-08	On September 29, 2008, the three Benelux government announced capital support to Fortis NV. The three Benelux governments to jointly invest €11.2 billion to support Fortis: The Dutch government to invest €4 billion in Fortis Bank Nederland Holding in exchange for a 49% stake, the Belgian government to invest €4.7 billion in Fortis Bank NV/SA in exchange for a 49% stake. and the Luxemburg government to invest €2.5 billion in Fortis Banque Luxembourg SA by way of a mandatory convertible loan. Following conversion, Luxembourg will have a 49% stake in Fortis Bank Luxembourg, in addition to other rights. Following the Sept 29 announcement, the Dutch government announced on October 3, 2008, that it had replaced the planned capital injection with the outright purchase of Fortis Bank Nederland, Fortis Insurance Netherlands, and Fortis's holding in ABN Amro Holding NV.
BPN	Portugal	11-Nov-08	On 11 November 2008, by Lei 62-A/2008, the government nationalized the capital stock of Banco Português de Negócios ("BPN"), which had run up accumulated losses of €700m and was facing an imminent breakdown of its ability to meet payments.
UBS	Switzerland	16-Oct-08	On 16 October 2008, the Swiss authorities took a 9.3 per cent stake in UBS with a CHF6 billion capital injection. Swiss National Bank will provide an 8 yr. loan of $ 54 bn to set up SPV which will acquire UBS' illiquid assets.

Name of parent bank	Country	Date of Intervention	Type and main features of Intervention / Resolution
Citibank	USA	23-Nov-08	On November 23rd, 2008, the U.S. government announced it would provide a package of guarantees, liquidity access, and capital to Citigroup. The US Treasury and the FDIC would provide protection against losses on an asset pool of approximately $306 billion of loans and securities backed by residential and commercial real estate and other such assets that will remain on Citigroup's balance sheet. As a fee for this arrangement, Citigroup would issue $7 bn of preferred stock with an 8% dividend rate. $4 bn of preferred will be issued to Treasury and $3 bn would be issued to the FDIC. The Federal Reserve would stand ready to backstop residual risk in the asset pool through a non-recourse loan. FDIC standard loss-sharing protocol: The guarantee is in place for 10 years for residential assets, 5 years for non-residential assets. Institution to retain the income stream from the guaranteed assets. The risk weighting for assets would be 20%. Treasury also to invest $20 billion in Citigroup from the TARP in exchange for preferred, non-voting stock with an 8% dividend to the Treasury. No dividends on common stock. Citicorp to issue warrants equal to 10% of total preferred. Citigroup to comply with enhanced executive compensation restrictions and implement the FDIC's mortgage modification program. On February 27th, 2009, it was further agreed that the Treasury would convert $25 bn worth of government-held preferred shares it already holds in the bank to common equity, so long as private investors contribute an identical sum, in a move to shore up the institution's capital base. As a result, the U.S. Treasury would own 36 percent of Citigroup's common stock and existing share shareholders would own approximately 26 percent of outstanding shares. The arrangement does not involve additional financial assistance from the Treasury. In addition, there was to be a reshuffle among the Board of Directors so that a majority of the Board would be comprised of new independent directors and this would be done as soon as possible.

Source: Laeven and Valencia bank failure dataset

Chapter 3. Collateral after the Brazilian Creditor Rights Reform

Bernardus F. Nazar van Doornik

Abstract

We investigate how the strengthening of creditor rights affected corporate debt structure, collateral liquidity, and collateralization rate following the 2005 bankruptcy law in Brazil. Using a large dataset from the Brazilian credit registry, we find that secured debt usage increased 13 percentage points after the reform, together with a reinforcement in the use of more liquid collateral agreements. We document that the law had a varying effect across groups of borrowers with different amounts of collateral pledged before the reform. Firms previously pledging amounts of collateral in excess of the value of the loan could access credit with a much lower collateralization rate after the introduction of the law. However, the collateralization rate significantly increased for firms with lower-pledge levels, imposing an extra cost on them. We show that a multiple banking set-up may give such borrowers an option out of overcollateralization, as foreign-owned banks demanded substantially less collateral compared with domestic-owned banks after the reform. These results are robust after controlling for a wide variety of possibilities.

JEL Classification: D23, G18, G21, G28, G33, H81.

Keywords: creditor rights, collateral, security interests, secured debt, collateralization rate, foreign banks.

1 – Introduction

On one hand, "one of the key channels through which financial development operates is by lowering the demand for collateral" (Liberti and Mian, 2010). On the other hand, protecting creditor rights, which is also linked with financial development, is documented as increasing secured debt use (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998; Levine, 1998, and 1999; Djankov, McLiesh, and Shleifer, 2007). In the light of these seemingly opposing views, we explore the role of collateral following the reforms in creditor rights sealed by the Brazilian bankruptcy law in 2005.

The reforms brought by the bankruptcy law (Law 11,101/2005) significantly strengthened the rights of secured creditors by giving them a higher priority when it comes to accessing the assets of the bankrupt firm. The law also exempted certain specific classes of collateral from reorganization and liquidation proceedings. Thus, it allowed banks to bypass the lengthy judicial process for seizing and liquidating the collateralized assets of the defaulting firm. Exploiting the bankruptcy law in a quasi-natural experiment, we investigate its effect on corporate debt structure; on the use of collateral agreements with different liquidity levels; and on the amount of collateral pledged by a firm in order to access new credit.

We have the right setting and the appropriate data for testing the effects of the Brazilian creditor rights reform. We use a panel data sample from the Brazilian credit registry, which consists of quarterly credit data for more than 790,000 firms from 2004:Q1 to 2005:Q4, where firms must be observed in the pre- and post-period. Overall, there are more than 5.2 million firm–time observations. The data allows us to identify banks, firms, loans, and collateral information over time. The unique quasi-natural experiment combined with the comprehensive dataset enables us to address the econometric identification challenges.

Besides identification issues, any attempt to examine the link between the strengthening of creditor rights and collateral potentially suffers from omitted variables. We use a set of fixed effects (firm, time / firm–time and bank fixed effects) when defined as appropriate. We also include a set of time-varying firm, bank and firm-bank level controls, depending on the regressions. Since the residuals may be correlated across different dimensions of the data, we base ourselves on Bertrand, Duflo and Mullainathan (2004), in order to cluster standard errors at the appropriate level.

More than 80% of the total loan amount granted in Brazil was classified as unsecured credit in 2004[1]. We find that *Secured debt* increased by an estimate of 13 percentage points after the reform. This goes in line with La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), Levine (1999), Djankov, McLiesh, and Shleifer (2007), who document higher secured creditor rights with an increase in secured debt. Results are robust when we control for time-varying firm characteristics. We test the robustness of our findings for sample periods of five and six quarters after the change in the law. The results suggest that a larger sample after the changed law also captures the change in collateral pledge. We also test whether the reform did start affecting *Secured debt* before the bankruptcy law's publication, and we find evidence that this is the case.

Following the increase in *Secured debt*, we document that the law increased the use of all types of security interests. By providing lenders with a higher priority in the distribution of credit claims, the reform allowed a broader class of assets to be pledged. Specifically, we find evidence that the law had a higher effect on the use of more liquid collateral agreements. We distinguish three groups of collateral agreements, depending on the ease with which the lender could repossess and sell the assets. Collateral with the least level of liquidity includes agreements in which the lender has only indirect possession on pledges of fixed assets. Indirect possession requires the bank to obtain court approval to repossess and sell the asset. In the case of firm liquidation, assets under this category are automatically set as part of the pool of assets in the bankruptcy petition and the bank can no longer exercise its rights. We find that the use of *Collateral with indirect possession* increased by one percentage point after the reform.

A more liquid agreement for using fixed assets as collateral is achieved by transferring the direct possession of the asset to the lender. This form of agreement is the fiduciary lien. The new law exempted creditors that have taken collateral in the form of fiduciary lien from the bankruptcy procedure that would affect all other secured and unsecured debt. However, the law also restricted the repossession of assets considered as core-assets[2]. In this case, the judge would still need to set the appropriate time in order to ensure the recovery of the firm before

[1] According to Erel (2011), the fraction of loans not collateralized in US was 25% in a sample of loan from the Survey of Term of Business Lending for the time period from 1987 to 2003.

[2] Core assets are essential property of a business without which a business would dissolve, since the company cannot carry on with its profit-making activities. The judge is the one that determines whether an asset is a core-asset depending on the type of business. Examples could include vehicles, equipment, machinery, industrial plants, land, etc...

the bank can repossess and sell the assets. We find that the use of *Collateral with direct possession* increased by four percentage points after the reform.

The evidence we find is a significant increase on the use of *Highly liquid collateral*. This type includes credit claims under fiduciary cession agreement of credit rights and rights over banking accounts (*e.g.* checks, fixed income investments, shares, debentures, deposits, and promissory notes). Because of the fiduciary feature, the bank has direct possession of credit claims under *Highly liquid collateral*. Hence, this category represents a "put option" for banks, which can be exercised when the borrower defaults on a loan. Moreover, the bank will not need to integrate the bankruptcy pool of creditors. We find that the use of *Collateral with direct possession* increased by eight percentage points after the reform.

Using a subsample of loans with information on *Collateralization rate* – the amount of collateral pledged divided by loan amount – we document that the *Collateralization rate* is very heterogeneous among firms in Brazil[3]. Additionally, banks tend to fully or over-collateralize their credit positions. We show that a reform that strengthens secured creditor's rights has a mixed effect on borrowers, depending on their previous level of collateral pledged. Collateral pledge significantly decreases for those borrowers who previously had to pledge amounts in excess of the value of the loan, and it significantly increased for those borrowers with a lower level of collateral pledged before the reform. We test the robustness of our prediction on a placebo, and confirm that the law had a standardization effect on banks' lending policy.

Strengthening creditor rights reduces borrowing costs and thus relaxes financial constraints, but it can also impose an extra cost on borrowers (Vig, 2013). We show that firms negatively affected by the reform might be able to undo the extra burden of having to pledge more collateral. We find evidence that borrowers in a multiple banking setup could at least mitigate the effect of the reform by contracting with foreign-owned banks. Our findings are based on a powerful identification within borrowers in order to disentangle the bank's demand for security interests from the firm's supply of collateralizable assets. Using a differences-in-differences methodology in an analogous manner as in Khwaja and Mian (2008), we test the demand of foreign banks for collateral in a sample of firms that could be harmed by the changes brought by the creditor rights reform.

[3] We find that the effect of the law concerning the demand for collateral was homogeneous across groups of firms with different levels of default risk.

Next, we test the demand of foreign banks for *Secured credit* in the whole sample of firms with multiple bank relationships. Both tests confirm that foreign banks demanded less collateral from their borrowers than domestic banks did after the reform. We consider a number of robustness tests and alternative explanations that may fully or partially account for the results reported. As we already exclude loans involving resources other than the bank's, we focus on controlling for portfolio reallocations and borrower-induced choice of multiple lenders. In all settings, results continue to hold, suggesting that the main findings are not driven by any of the raised possibilities. Results are robust to different event windows.

To our knowledge, this is the first paper in the literature that empirically tests the effect of the strengthening of creditor rights on collateral pledge at both the macro-level (*i.e.* focusing on corporate debt structure) as well as at the micro-level (*i.e.* analyzing the collateralization rate of new loans). We also provide the first paper in the literature that documents the effect of a creditor rights reform on collateral agreements with different liquidity levels. Besides Beck, Ioannidou and Schafer (2012), this is the only paper that properly disentangle a firm's supply of collateralizable assets from bank's demand for its security interests. With a sample of firms with multiple banking relationships, we are able to examine the demand of competing banks for collateral. Although the role of foreign banks is controversial because they might displace local lending, thereby tightening a firm's overall access to credit (Bruno and Hauswald, 2014), our paper documents foreign banks as catalysts for financial development.

The rest of the paper is organized as follows. The following section examines the related literature in the field and sets our predictions. Section 3 discusses the reforms brought by the Brazilian bankruptcy law. Section 4 presents the dataset and the main descriptive statistics. Section 5 documents our empirical analysis, including the model we propose to overcome the current challenges, our main findings, as well as a battery of robustness tests. Finally, Section 6 concludes with the main messages of the paper.

2 – Literature review

Credit rationing originates from the presence of informational asymmetries. Since collateral is expected to have a mitigating effect on informational asymmetries, collateral may solve the credit-rationing problem (Steijvers and Voordeckers, 2009). One category of theoretical models considers collateral as a screening device, which reduces the *adverse selection* problem. In this case, collateral has a signaling role, where the willingness of the firm to pledge security interests positively influences the quality of the loan, as perceived by the

bank (Bester, 1985, 1987). From this stream of literature, it is concluded that, in equilibrium, low-risk borrowers would pledge more collateral than high-risk borrowers.

Another category of theoretical models considers collateral as an incentive device, reducing the *moral hazard* problem (Boot *et al.* 1991; Boot and Thakor, 1994). Collateral can be a means of preventing high-risk firms switching from a lower to a higher risk project, or from making less effort to develop the project, given the possibility of losing the collateral pledged. Their theories predict the opposite, namely, high-risk borrowers would pledge more collateral than low-risk borrowers.

Strengthening creditor rights reduces borrowing costs and thus relaxes financial constraints. The economic justification for stronger creditor rights is that the space for debt contracts can be expanded between the borrower and the lender (Vig, 2013). The reduction in the cost of borrowing may come from the *moral hazard* channel since stronger creditor rights mitigate borrower's misbehavior. However, the lower cost of borrowing incentivizes firms to signal themselves by pledging more collateral. Thus, high-risk firms and low-risk firms would pledge more collateral after a creditor rights reform. This goes in line with La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), Levine (1999), Djankov, McLiesh, and Shleifer (2007), who document higher secured creditor rights with an increase in secured debt.

This leads us to our first prediction.

Prediction 1. A reform that strengthens secured creditor rights would cause secured debt to increase

Few studies explicitly make the distinction among different types of collateral. Chan and Kanatas (1985) distinguish between inside collateral (belonging to the business) and outside collateral (personal guarantees). The difference between these two types is the higher implicit value of personal collateral as a discipline device. The likelihood that the borrower will feel personal loss is higher when granting personal collateral. Liberti and Mian (2010) make a distinction between firm-specific (firm inventory/machinery, equipment, and account receivables) and non-firm-specific assets (land and Real State, bonds and shares). The authors find that there is a strong tendency for the composition of collateral assets to shift from firm specific to non-firm specific assets when loan risk increases. One of the reasons might be that the value of firm-specific assets diverts more between the lender and the borrower, compared with non-firm specific assets.

Vig (2013) distinguishes assets used as collateral according to their tangibility (fixed assets). Vig (2013) shows that strengthening secured creditor rights increases secured debt capacity and lowers the cost of borrowing, but it also exposes firms to the threat of being prematurely liquidated. Here we see a substitution effect, where a standard secured debt contract may lead to inefficient liquidations when firms value continuation. For this reason, firms that value continuation will have a higher implicit value for core assets (more associated with fixed assets) compared with non-core assets (more associated with liquid assets).

Ceteris paribus, firms will prefer to pledge non-core assets, given the threat of being prematurely liquidated. On the other hand, if banks can mitigate moral hazard by using any asset as collateral, they will prefer to demand liquid assets, in order to recover as smoothly as possible any loss from debtor default. If non-core assets are liquid assets with a market value accepted by both parties (no implicit value), the use of such assets would constitute a Pareto improvement, as it makes none of the parties worse off. Firms would be able to access credit pledging collateral with assets that do not compromise its profit-making activities, and banks could mitigate moral hazard with assets easy to repossess and sell at market value. This brings us to our second prediction.

Prediction 2. Better protection of creditor rights increases the demand for collateralizable assets, in particular for the more liquid types of security interests.

The empirical work seems to confirm that collateral plays a disciplinary role in the behavior of borrowers (Berger and Udell, 1995; Brick and Palia, 2007), thus solving the *moral hazard* problem. In contrast, Lehmann and Neuberger (2001) and Jimenez *et al*. (2006) suggest a signaling value of collateral, which would solve the *adverse selection* problem. Nevertheless, Cressy and Toivanen (2001) find no significant relationship between risk and the pledging of collateral. One explanation for the inconsistency of these empirical researches might be the endogeneity issue of collateral and risk, since borrowers who provide more guarantees receive a better rating (Steijvers and Voordeckers, 2009).

Strengthening creditor rights reduces borrowing costs and thus relaxes financial constraints, but it can also impose an extra cost on certain borrowers (Vig, 2013). In analyzing the effect of a reform in creditor rights, instead of distinguishing borrowers by their risk[4], given

[4] Following the literature that analyses collateral pledge for firms with different risk levels, we tested predictions (1) and (3) by differentiating groups of firms with opposing default risk probabilities. In one sample we select *Low-risk firms*, which have an average rating equal or above the 75th percentile among all lenders before 2005:Q1 and zero otherwise. In the other sample, we select *High-risk firms*, which have an average rating equal or below the 25th percentile among all lenders before 2005:Q1 and zero otherwise. By running our specifications

the endogeneity problems, firms could be differentiated according to the amount of collateral pledged before the reform. A firm can pledge a certain level of collateral (high or low) in a disciplinary and in a signaling role. Such an approach would aim at comparing the level of collateral pledged by the same firm, before and after a reform, and would allow for both *moral hazard* and *adverse selection* problems to coexist.

If banks value collateral more, they may standardize a level of collateral. This can create an extra cost that would be enforced on those firms that had a lower level of collateral pledged before the reform. Borrowers who were signaling with lower levels of collateral will incur an extra cost to signal their quality to the bank, while borrowers who were pledging lower levels of collateral as a disciplinary measure will bear an extra cost simply to comply with their original agreement.

This leads us to our third prediction.

Prediction 3. A reform that strengthens secured creditor rights has a mixed effect on borrowers, depending on their previous level of collateral pledged. Collateral pledge would decrease for those borrowers who previously had to pledge collateral that exceeded the value of the loan (firms that are better off); and it would increase for those borrowers with a lower level of pledged collateral before the reform (firms possibly worse off and then facing additional cost).

The truth is that firms are not eager to pledge collateral. First, there is the risk of losing the collateral pledged in the case of default. Second, firms incur other costs, such as making additional reports to financial institutions, or agreeing on more restrictive asset usage (Coco, 2000). Third, the entrepreneur incurs a loss of welfare due to restrictions on selling the asset. Forth, pledging collateral limits the firms' ability to obtain future loans from other lenders. In this last drawback, the lending bank is put in a position of power (Steijvers and Voordeckers, 2009).

Banks can also ask for more collateral than necessary, in an effort to build a 'quasi-monopoly' position with each borrower. This strategy works as a barrier-to-entry for other banks (Lehmann and Neuberger, 2001). For firms with multiple bank relationships that feel threatened by a reform in creditor rights (*e.g*. the main bank demands a higher amount/degree of collateral in order to extract rents), one alternative in order to maintain the balance between

for *Low-risk firms* and *High-risk firms*, we find that the impact of the law was homogeneous between these two groups of firms. We also differentiate *Low-risk firms* and *High-risk firms* by the median of the average rating of the firm with all lenders before 2005:Q1, but results continue to hold.

credit supply and the demand for collateral might be found within their own multiple banking setup.

Bank ownership is one dimension that might differentiate a bank with regard to its lending techniques and loan pricing models. Using a sample of Bolivian firms that borrow from domestic and foreign banks, Beck, Ioannidou and Schafer (2012) show that foreign banks grant loans with lower interest rates and shorter maturity and are more likely to demand collateral than domestic banks. According to the authors, foreign banks have a more transaction-based lending technique, basing their prices on credit ratings and collateral pledges. Domestic banks have a more relationship-based lending technique, pricing according to length, depth and breadth of the relationship with the borrower.

This brings us to prediction 4.

Prediction 4: For firms that value multiple relationships and could be made worse off by a strengthening of creditor rights, domestically-owned banks could be a strategic alternative to circumvent the extra cost imposed by the higher demand for collateral.

3 – Creditor rights reform

3.1 – Pre-reform

The old legislation regulating the Brazilian bankruptcy procedures, prescribing both reorganization and liquidation, was ineffective in maintaining the value of a firm's assets and protecting creditors' rights in liquidation.

Concerning the reorganization process (the old term is *concordata*), creditors and debtor should be unanimous in the decisions regarding the restructuring procedures. In most cases, there were serious issues of collective enforcement problems arising from coordination failures. Additionally, creditors could not remove the debtor manager from office, which would not incentivize creditors to provide additional financing to potentially viable firms. The old law only postponed debt payments and with time, a firm's restructuring plans would be turned into a bankruptcy liquidation.

Liquidation procedures were typically lengthy and costly. On average, resolving an insolvency case would take up to 10 years, mainly because of procedural inefficiency and lack of transparency. Figure 1 illustrates this dimension of inefficiency, comparing Brazil with

seven other groups of countries[5]. The figure shows that the average time to close a business in Brazil was more than twice the average for Latin America (Araujo *et al.*, 2012). As a result, assets would often be devalued over the course of the procedures.

The government attempted to improve creditor rights in 2004[6], allowing banks to repossess and sell assets under fiduciary lien[7]. In particular, we highlight the fiduciary cession agreement of credit rights and rights over banking accounts (defined in our paper as *Highly liquid collateral*), and fiduciary assignments on equipment, vehicles, real estate, and other asset claims (*Collateral with direct possession*). However, due to political uncertainty, the banking system was skeptical about the implementation of the law. There was considerable uncertainty about the ability of the court system to operationalize the law and whether assets under fiduciary lien agreements would be part of the pool of assets of the bankruptcy petition.

Moreover, due to successor liability, which implied that in liquidation the debts of a firm were passed on to the new equity holders, firm assets were more likely to be sold piecemeal than jointly. This further reduced the proceeds from the liquidation. Furthermore, the bankruptcy priority rule was very punitive to secured creditors[8]. The old law specified the following order: first, labor claims; second, tax claims; third, secured creditors' claims; and finally unsecured creditors' claims and trade debts.

The inefficiencies that characterized the former bankruptcy procedures lead to significantly lower secured credit recovery values. The average recovery rate – expressed in cents per claim dollar that creditors are able to recover from an insolvent firm – was 0.2 cents on the dollar in Brazil before the new bankruptcy law (World Bank, 2005). Since this fact was known to creditors *ex-ante*, collateral was undervalued. Banks would either supply unsecured

[5] Groups of countries include the Organization for Economic Cooperation and Development (OECD), Latin America and the Caribbean (LAC), the Middle East and North Africa (MENA), Europe and Central Asia (ECA), East Asia and the Pacific (EAP), South Asia (SAS), and Sub-Saharan Africa (SSA).

[6] Law 10.931 enacted in August 2, 2004.

[7] Under the fiduciary lien, the direct and indirect possession of the asset stays with the lender, and repossession could take place without the need of judicial court procedures (Araujo *et al.*, 2014).

[8] The seminal paper by La Porta *et al*. (1998), titled "Law and Finance" ranked Brazil low in terms of creditor rights. Using an index that varies from zero to four, with higher scores, higher creditor rights, Brazil attained the score of one. The index is formed by "adding one when (1) the country imposes restrictions, such as creditors' consent or minimum dividends to file for reorganization; (2) secured creditors are able to gain possession of their security once the reorganization petition has been approved (no automatic stay); (3) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm; and (4) the debtor does not retain the administration of its property pending the resolution of the reorganization" (La Porta *et al*, 1998).

credit, substituting collateral by higher interest rates and lower maturity, or would supply secured credit, by demanding collateral in excess of the loan's value.

3.2 – Post-reform

The new bankruptcy law (Law 11,101) was published in February 2005 and came into force in June of the same year. It was inspired by chapters 7 and 11 of the US bankruptcy code. It sealed the creditor rights reform that started in 2004 and increased the chance of viable businesses being restructured.

The new law introduced a new reorganization procedure where the firm could enter into an extrajudicial reorganization, an out-of-court process close to the "pre-packaged bankruptcy" under the US code. A reorganization plan can be approved by the majority of creditors (60% of each class or group of creditors), instead of the need for the unanimous decision of all players involved. It is also possible for the firm to enter into a judicial reorganization, based on the US chapter 11, where creditors may remove the debtor manager from office and demand the appointment of new managers by the court. In order to give creditors incentives to provide additional financing for the reorganization of businesses, post-petition credits have priority over the assets in the debtor's pre-petition estate.

In the worst-case scenario, where the firm's restructuring plan does not receive enough support from the creditors, a judicial reorganization is turned into a bankruptcy liquidation. With the new law, legislators aimed to foster the distress market and removed successor liability. Thus, claims remain as liabilities of the debtor and are no longer passed to the purchasers. This increases the value of distressed firms when sold in full or by business units (Ponticelli, 2014).

In case of a bankruptcy procedure, secured creditors are now given a higher priority. The new law still prioritizes labor claims, but now it sets limits on the amount to be paid to labor debt, with the introduction of a cap of 150 times the monthly minimum wage[9]. Additionally, tax authorities lost their priority in relation to secured credit claims up to the limit of the encumbered amounts. The higher priority accorded to secured creditors increased their protection in exercising their creditor rights.

[9] In 2005, the monthly minimum wage was R$300, which corresponds approximately at the time to US$100.

The law had a clear rule for assets under fiduciary lien. Both fiduciary cession agreement of credit rights and rights over banking accounts (defined in our paper as *Highly liquid collateral*), as well as fiduciary assignments on equipment, vehicles, real estate, and other asset claims (*Collateral with direct possession*) would be excluded from the pool of assets under the bankruptcy petition. In other words, the law exempted from the bankruptcy procedure that would affect all other secured and unsecured debt creditors that had taken collateral in the form of fiduciary lien. This was a novel provision of the law, which gave banks an extra incentive to use these types of guarantees. However, the law restricted the repossession of assets considered as core-assets[10] under *Collateral with direct possession*. In this case, the judge would need to set an appropriate time to allow the recovery of the firm, before the bank could repossess and sell the assets.

With the changes brought by the new bankruptcy law, banks could increase their recovery rate in the case of financial distress, and could evaluate *ex-ante* their likely recovery on each loan. Figure 2 illustrates the increase in the recovery rate after 2005, reaching 12 percent at the end of that year[11]. In addition, the average time to close a business in Brazil has fallen from 10 to 4 years, reducing the depreciation of assets. The significant boost in the rights of secured creditors affected the use of collateral in the country. Banks increased their demand for secured credit, especially for more liquid types of collateral, and decreased the variation in collateral pledged by firms.

4 – Data and descriptive statistics

The primary database employed in this study is the credit registry from the Central Bank of Brazil, which contains specific information on bank–firm credit relationships. The dataset covers the period from 2004:Q1 to 2005:Q4, where we are able to follow loans, firms, and banks over time. Loans that each borrower has with banks operating in Brazil are registered above a threshold of 5,000 Brazilian Real (around 2,500 USD in December 2012). Data is available at quarterly frequency and is of very high quality since the total outstanding loan amount at the credit registry must match the bank's quarterly accounting figures for credit loan.

[10] Core assets are essential property of a business without which a business would dissolve, since the company cannot carry on with its profit-making activities. The judge is the one that determines whether an asset is a core-asset depending on the type of business. Examples could include vehicles, equipment, machinery, industrial plants, land, etc...

[11] The average of Latin American and OECD countries remained stable (29% and 67%, respectively) (Araujo *et al.*, 2012)

Central Bank ensures the quality of the data, and intermediaries use the credit registry as a screening and monitoring device for borrowers.

In addition, we use collateral information on financial contracts also extracted from the credit registry. The benefit of a credit registry is that it allows creditors' claims in secured assets to be easily verifiable by third parties. Secured assets need to be registered with a notary and, in most cases, cannot be pledged for different loan contracts. Banks are asked to send information on whether the loan is secured or unsecured at each quarter. In the case that a loan is secured, we have information on both the type of the security and its market value.

Some drawbacks of the collateral database include the presence of a few gaps for banks that did not send all the quarterly collateral files. Moreover, banks might register just part of their secured portfolio in specific quarters. And furthermore, the information on the market value of the assets pledged by the banks as collateral is not always reliable. In order to mitigate these issues we perform several tests to detect absence of collateral information. Gaps on collateral information are seldom and more prominent in smaller institutions[12]. We employ a strategy where we consider a loan as secured if the loan is registered in the credit register as "secured" in any quarter of the whole dataset[13]. Finally, in order to study the amount of collateral pledged by the firm, we consider a sample of secured loans, where we keep just the first observation of each loan contract.

We also obtained from Central Bank consolidated and unconsolidated balance sheet data with quarterly frequency of all the banks operating in Brazil. In addition, we have bank ownership and conglomerate information. After several checkups to ensure that the data is of high quality, we merge these different datasets using the public bank identification number.

We keep all non-financial and private firms with outstanding credit in the credit registry. We exclude firms that do not appear throughout the sample period that goes from 2004:Q1 until 2005:Q4. The sample of banks includes commercial banks and multiple banks with a commercial portfolio[14]. Furthermore, banks should appear in the pre- and in the post-periods. This partially controls for mergers and acquisitions among banks. We further control for M&A

[12] Results are robust to dropping such institutions.

[13] Results are robust to considering loans secured only at the quarter we merge the loan files with the collateral files.

[14] The Brazilian Development Bank (BNDES) is excluded from the sample given its particular objectives and operational differences, especially in its cost of funding and its long-term assets.

and rebalancing of the bank's loan portfolio, since we can track whether each loan was initiated by the bank itself, or whether there is a new relationship with the acquirer bank.

Table 1 shows the definitions of the variables used in testing each of the predictions.

– Insert Table 1 here –

4.1 – Sample and variables for Prediction 1

We select a sample of firms with outstanding loan amount before and after the reform of creditor rights. We keep firm observations if the firm appears in the pre-period for at least three out of the four possible quarters. The same applies for the post-period. Therefore, we keep the firm if there is a 75% minimum appearance throughout the sample period. Results are robust to the loosening of such restriction.

Loan amounts are aggregated at firm and quarter level. In this setting, we have 5,252,939 firm–time observations for 796,582 firms. The dependent variable is *Secured debt*, defined as the ratio of outstanding debt amount guaranteed by any type of collateral from borrower *i* in quarter *t*. Table 2 – Panel A shows the summary statistics of *Secured debt* and all other variables used to test prediction 1. A firm's debt structure was composed on average of 17% of secured debt before the law. After the law, the ratio of secured debt increased to 27% (0.10 in the "Diff" column of Table 2 – Panel A). This is an economic and statistically significant change, as we can observe from the p-value of the T-test column.

– Insert Table 2 here –

From the overall sample, one can notice that the average firm debt was around USD 17.000. Additionally, most of the firms had just one bank relationship. The participation of overdraft loans was around 40%, factoring 13%, term loans 9%, and leasing and export loans around 0.1%. The omitted category is regular loan. From the standard deviation measures, one can notice that there is extreme variability in the firm variables. Such firm differences can be correlated with the pledge of collateral, so we formally control for these variables in the

regressions analysis. It is important to recall that systematic differences across firms are controlled in the regressions by firm fixed effects.

Figure 3 shows the dynamics of secured debt in the eight quarters of our analysis. At a first glance, the creditor rights reforms that started in August 2004 with the Fiduciary law and were sealed in February 2005 with the Bankruptcy law have increased the use of secured debt. It may be the case that collateral law matters more for credit market development than bankruptcy law (Haselmann, Pistor and Vig, 2008). Although the figure shows a high increase of secured debt by the third quarter of 2004, for the purpose of this paper we do not take a position on which law had a greater effect on the supply and demand for collateral. We rather analyze the complementary effect of both laws in the usage of collateral.

– Insert Figure 3 here –

4.2 – Sample and variables for Prediction 2

The same sample selected for prediction 1 is used to test prediction 2. The three dependent variables in this setting are:

- *Highly liquid collateral*, defined as the ratio of outstanding debt amount guaranteed by highly liquid collateral. Security interests in this category include checks, fixed income investments, shares, debentures, deposits, promissory notes, and other credit claims under fiduciary cession agreement of credit rights and rights over banking accounts;
- *Collateral with direct possession*, defined as the ratio of outstanding debt amount guaranteed by collateral with the direct and the indirect possession of the lender. Security interests in this category include fiduciary assignments on equipment, vehicles, real estate, and other asset claims;
- *Collateral with indirect possession*, defined as the ratio of outstanding debt amount guaranteed by collateral with the indirect possession of the lender. Security interests in this category include pledge on equipment, vehicles, real estate, mortgages of real properties and other asset claims.

From Table 2 – Panel B we can see that a firm's debt structure before the change in the law was composed, on average, by 8% of debt secured by *Highly liquid collateral*, 7% of debt

secured by *Collateral with direct possession*, and 1% of debt secured by *Collateral with indirect possession*. After the law was introduced, debt secured by *Highly liquid collateral increased* to 14%, *Collateral with direct possession* increased to 10%, and debt secured by *Collateral with indirect possession* increased to 2%. Figure 4 shows the dynamics of secured debt guaranteed by different types of collateral in the 8 quarters of our analysis.

– Insert Figure 4 here –

4.3 – Sample and variables for Prediction 3

In order to test prediction 3, we select a sample of firms with secured loans before and after the reform in creditor rights. Since the information on the market value of the assets pledged by the banks as collateral is not always reliable, we consider only the first observation of each loan. Collateral value must be greater than zero, as we aim to test the intensive margin effect of the amount of collateral pledged by the same firm, before and after the reform. A loan is defined as a single firm–bank relationship. If a firm takes out several loans from the same bank at a given quarter, we aggregate all loans for this firm–bank pair. Additionally, each loan must have information on the following: loan amount, maturity, interest rate, credit rating, and type. The controls for loan type are the percentages of loans that are classified as overdraft, factoring, term loans, leasing, and export loans (Schnabl, 2012). The omitted category is regular loan.

We differentiate firms depending on the amount of collateral they pledged before the reform[15]. We define the two groups of borrowers according to their previous *Collateralization rate* compared with the sample median *Collateralization rate* before the reform. The median *Collateralization rate* before the reform is one. *Low-pledge firms* are defined using a dummy variable that takes the value one if firm *Collateralization rate* before the law is equal or below one, and zero otherwise. *High-pledge firms* are defined using a dummy variable that takes the value one if firm *Collateralization rate* before the law is above one, and zero otherwise.

Table 3 shows the summary statistics of *Collateralization rate* and all other variables of both groups of firms used to test prediction 3. We can notice that the mean *Collateralization*

[15] A firm can pledge a certain level of collateral (high or low) in a disciplinary and in a signaling role. As our approach aims at comparing the level of collateral pledged by the same firm, before and after a reform, it allows for both *moral hazard* and *adverse selection* problems to coexist.

rate for *Low-pledge firms* before the reform was 0.95. After the reform, the rate increased to 1.09. *High-pledge firms*, on the contrary, had an extremely high *Collateralization rate* of 8.52 before the reform. This rate came down to 5.85 after the reform.

– Insert Table 3 here –

Figure 5 shows the Kernel density estimate for *Collateralization rate* before and after the reform. For the purpose of a better visualization of the difference in distributions, we winsorize *Collateralization rate* at 95%. One can notice that the collateral pledged after the reform had a clear tendency to be concentrated. We confirm the non-equality of the distributions of *Collateralization rate* before and after the reform using the two-sample Kolmogorov-Smirnov test for equality of distribution functions. We interpret this as a first indication that the law had a standardization effect on the amount expected to be pledged by firms in order for a bank to grant a new loan.

– Insert Figure 5 here –

4.4 – Sample and variables for Prediction 4

In order to test for prediction 4, we first use a subsample used to test prediction 3. Specifically we focus on *Low-pledge firms* since they that might have an extra cost in pledging more collateral after the reform. Specifically, we investigate the impact on the intensive margin on the same firm, at the same point in time, for foreign banks versus domestic banks. First, in a sample of *Low-pledge firms*, we test whether the demand of foreign banks for collateral increased more compared with domestic banks after the changes brought by the creditor rights reform. Next, in the whole sample of firms with multiple bank relationship, we test whether the demand of foreign banks for *Secured credit* increased more compared with domestic banks after the reform.

In the analyses for *Collateralization rate*, we track 7,795 loans. Table 4 – Panel A shows descriptive statistics of *Collateralization rate* and all other variables for each group of banks, according to their ownership. Before the reform, the *Collateralization rate* was 0.98 for foreign banks, 0.89 for government banks and 0.78 for private domestic banks. After the reform,

Collateralization rate increased to 1.01 for foreign banks, 1.13 for government banks and 1.22 with private domestic banks.

– Insert Table 4 here –

However, the validity of the identification strategy depends on a similar trend in the pre-period of the variable *Collateralization rate* from foreign banks and other banks, conditional on all controls. The requirement for a similar trend only applies to how much foreign banks, private domestic banks, and government banks depart from their time-invariant component in the pre- and post-period. Data do not allow us to run ex-ante placebo tests.

Figure 6 shows the *Collateralization rate* by bank ownership for *Low-pledge firms*. We can note that the change in the law had a greater effect on those with relationships with domestic banks. Before the law reform, collateral pledge with domestic banks was lower than that for foreign and government-owned banks, but after the law reform, this situation turned in the opposite direction, with domestic banks demanding higher levels of collateral compared with foreign banks. It is interesting to note that for *Low-pledge firms* the lending policy of foreign banks remained constant after the reform. In any case, we document the preference of banks to fully or over-collateralize their credit positions after the reform.

– Insert Figure 6 here –

In the analyses for *Secured credit*, we track 5,252,939 loans. Table 4 – Panel B shows descriptive statistics of *Secured credit* and all other variables for each group of banks, depending on their ownership. Before the reform, the *Secured credit* was 0.29 for foreign banks, 0.14 for government banks and 0.33 with private domestic banks. After the reform, *Secured credit* increased to 0.35 for foreign banks, 0.24 for government banks and 0.51 for private domestic banks. Figure 7 shows the level of *Secured credit* by bank ownership. Again, domestic banks detach from foreign banks after the creditor rights reform.

– Insert Figure 7 here –

The differences in the means of *Collateralization rate* of government banks compared with foreign or with private domestic banks are statistically significant. The same applies to the means of *Secured credit*. The difference in means of relationship controls and bank balance sheet variables among foreign, private domestic, and government banks is statistically significant. For this reason, the need to include them as controls in the regression analysis.

It is possible that both subsamples used to test prediction 4 are not representative of the population intended to be analyzed. As we select firms with multiple banking relationships, these firms are expected to be larger firms. As we do not know the public identity of the firm, their location, nor their industry, it is difficult for us to give an account of the importance and the direction of the selection bias. To the extent that medium and large firms represent almost 65% of the Brazilian GDP in 2004[16], and that the non-exclusivity in banking relationship is the most controversial in the literature, the selection bias may actually be beneficial for our analysis. These are the situations where the firm may have a choice in deciding which bank to contract to, which is exactly what we want to capture in terms of collateral pledge.

5 – Empirical analysis

In this section, we empirically analyze the theoretical predictions laid out in Section 2. However, identifying a causal effect on collateral in the change to creditor rights poses important challenges.

First, there is a lack of a common identification system for loans, their guarantees, and borrowers, making the matching of large samples difficult. We overcome this difficulty thanks to the richness of the dataset that allows us to identify banks, firms, loans, and collateral information over time. Given also the several loan characteristics the dataset possesses, we are able to observe the dynamics of each loan, whether it is secured or not, and the type of security interests pledged by the banks, among several other variables. Given the size of the overall sample, inferences are robust enough to enlighten our knowledge regarding collateral pledge.

Second, any attempt to examine the link between the strengthening of creditor rights and collateral potentially suffers from omitted variables. We use a set of fixed effects (firm, time, firm–time, and bank fixed effects) when appropriate. Each of the fixed effects enables us to

[16] Estimates are from the Brazilian Institute of Geography and Statistics (IBGE).

control for a dimension of unobserved heterogeneity that affects the dynamics of the collateral pledged. Moreover, we include time-varying firm, bank, and firm-bank level controls, depending on the regressions. These controls enable one to check the robustness of the findings, in particular whether the inclusion of other covariates reduces the estimated impact of the reform in the baseline model. Last, but not least, since the residuals may be correlated across different dimensions of the data, we base ourselves on Bertrand, Duflo and Mullainathan (2004), in order to cluster standard errors at the appropriate level.

Table 5 is the one that best captures the main identification strategies. We collapse the data into a single data point (based on averages) both before and after the reform. This results in two data points per unit of observation, one data point for the pre-reform regime and one point for the post-reform regime. This time-collapsing of the data ensures that the standard errors are robust to Bertrand, Duflo and Mullainathan (2004) critique[17].

– Insert Table 5 here –

In Panel A, we report the before-after results for the variable *Secured debt*. As can be seen, *Secured debt* increased 9 percentage points after the reform. In Panel B, the dependent variables are *Highly liquid collateral*, *Collateral with direct possession*, and *Collateral with indirect possession*. As we can see, all classes of collateral agreements increased, in particularly, *Highly liquid collateral* with 6 percentages points. In Panel C, we report the opposite before–after results of the variable *Collateralization rate* for *Low-Pledge firms* and *High-Pledge firms*. In Panel D, we show that *Collateralization rate* for *Low-Pledge firms* after the reform changed less for foreign banks, with minus 14 percentage points in comparison to domestic banks (Government and private domestic banks). In Panel E, we show that *Secured credit* for firms with multiple banking relationships after the reform changed less for foreign banks, with minus 9 percentage points, than for domestic banks.

[17] The Bertrand, Duflo and Mullainathan (2004) critique relates to serial correlation – the tendency for one observation to be correlated with those that have gone before – especially in differences-in-differences models. The simplest and most widely applied approach is simply to time-collapse the data. We believe that our number of bank clusters (>50 banks) does not cause biased standard errors or misleading estimates.

5.1 – Effect of the reform on corporate debt structure

We begin with prediction 1, which states that a reform that strengthens secured creditor rights would cause secured debt to increase. The dependent variable is $Secured\ debt_{i,t}$, defined as the ratio of outstanding debt amount guaranteed by any type of collateral of borrower *i* in quarter *t*.

We then estimate the following regression:

$$Secured\ debt_{i,t} = \alpha_i + \alpha_t + \beta_1 Post_t + \gamma_1 X_{i,t} + \gamma_2 Y_{i,t} + \varepsilon_{i,t} \quad (1)$$

where *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4 and zero otherwise. The sample period starts in 2004:Q1 and ends in 2005:Q4. We include firm and time fixed effects, respectively α_i, and α_t, controlling for unobserved heterogeneity at each of both dimensions. $\varepsilon_{i,t}$ is an idiosyncratic error term. Since the residuals may be correlated across firms and across time, we cluster standard errors at the firm–time level. Vector $X_{i,t}$ controls for a set of observable characteristics of firm *i* at time *t*, including the size of the debt, the number of lenders, and the weighted average rating. Vector $Y_{i,t}$ controls for loan type as percentages of loans that are classified as overdraft, factoring, term loans, leasing and export loans (Schnabl, 2012). The omitted category is regular loan. In order to check whether the inclusion of covariates reduces the impact estimated for the reform in the baseline model, we also show estimates of equation (1) without vector $X_{i,t}$ and without vector $Y_{i,t}$.

Table 6 provides the main results of the baseline model, where we regress *Secured debt* on the reform of creditor rights. Columns (1) to (3) show the effect of the dummy *Post* on *Secured debt* in the period from 2004:Q1 to 2005:Q4. In column (1), we present the results of equation (1) suggesting that the reform had a strong effect on collateral pledge. The estimate of *Post* is positive, statistically significant and economically meaningful. The reform increased *Secured debt* by an estimate of 14 percentage points. Here, we include firm and time fixed effects, but do not control for time-varying firm characteristics.

– Insert Table 6 here –

Results are also robust when we control for time-varying firm characteristics, as one can observe in column (2). Even when we control for loan type characteristics, results remain statistically and economically significant. The reform increased *Secured debt* by an estimate of 13 percentage points. Regarding our firm controls, the higher the debt size the higher *Secured debt* will be, with an estimate of four to six percentage points – columns (2) and (3), respectively. However, an additional lender is estimated to have a negative effect of around three to four percentage points in *Secured debt*, whereas a change to a higher category in the credit rating scale has a negative effect of one percentage point. Concerning the type of loans, there is considerable heterogeneity on the estimated effect, relative to regular loans, on *Secured debt*. Term loans appear to be the most significant type of loan to positively influence *Secured debt*, with an estimate of 32 percentage points – column (3).

We consider a number of robustness tests and alternative explanations that may fully or partially account for the results reported in Table 6. One argument could be that the sample period of four quarters in the pre-period and four other quarters in the post-period is not appropriate to understanding the long-run effect of reform. To address this concern, we test equation (1) for sample periods of five and of six quarters after the law changed. The results suggest that a larger sample after the change also captures the change in collateral pledge.

Another argument, as discussed by Haselmann, Pistor and Vig (2008), it that collateral law may matter more for credit market development than bankruptcy law. In our case, there are two laws in place. The Fiduciary law of August 2004 and the Bankruptcy law of February 2005 that we consider as having a complementary effect. To address the concern that the effect of the first reform is the main cause of the increase in *Secured debt*, we test equation (1) where the reform takes place in 2004:Q3, with two quarters in the pre-period and two quarters in the post-period. Results suggest that this might be the case. Moreover, the exact content of the Bankruptcy law could hardly be anticipated before its publication, because of conflict of interest between the fiscal authority and the banking sector on the priority of credit claims and the several passages through the congress and the senate (Ponticelli, 2014).

5.2 – Effect of the reform on collateral type

In the case that a loan is secured, banks are asked to send information on what type of the security interest is being used as collateral. We group collateral agreements in three categories of liquidity, depending on the degree to which the assets can be possessed and sold. We define *Highly liquid collateral*, as the ratio of outstanding debt amount guaranteed by

highly liquid collateral. Security interests in this category include checks, fixed income investments, shares and debentures, deposits, promissory notes, and other credit claims under fiduciary cession agreement of credit rights and rights over banking accounts.

The second most liquid category of collateral agreements is *Collateral with direct possession*, defined as the ratio of outstanding debt amount guaranteed by collateral under the direct and the indirect possession of the lender. Security interests in this category include fiduciary assignments on equipment, vehicles, real estate, and other asset claims. The least liquid type of collateral agreements includes *Collateral with indirect possession*, defined as the ratio of outstanding debt amount guaranteed by collateral under the indirect possession of the lender. Security interests in this category include pledge on equipment, vehicles, real estate, mortgages of real properties, and other asset claims.

As discussed in the Section 3, the law had a clear rule for assets under fiduciary lien. Assets under *Highly liquid collateral* and under *Collateral with direct possession* would be excluded from the pool of assets under the bankruptcy petition. This gave banks an extra incentive to use these types of guarantees, in special of *Highly liquid collateral*, because of the absence of repossession restrictions in case of firm liquidation. We run equation (1) for these three different dependent variables. All the controls are kept the same for prediction 2.

Table 7 decomposes the impact of the Brazilian creditor rights reform on secured debt, depending on the lender's ability to repossess and sell the collateralizable assets. The dependent variable is *Highly liquid collateral* in columns (1) to (3); *Collateral with direct possession* in columns (4) to (6); and *Collateral with indirect possession* in columns (7) to (9). The reform increased the use of *Highly liquid collateral* by an estimate of eight percentage points. Columns (4) to (6) shows that the reform increased the use of *Collateral with direct possession* by an estimate of four percentage points. The last three columns of Table 7 show that the reform increased the use of *Collateral with indirect possession* by an estimate of one percentage point.

– Insert Table 7 here –

The differences in estimates between each combination of the results in columns (3), (6) and (9) are statistically significant. The law had an effect on the use of security interests, in particular on more liquid collateral agreements.

5.3 – Effect of the reform on collateralization rate

Prediction 3 states that a reform that strengthens a secured creditor's rights has a mixed effect on borrowers, depending on their previous level of pledged collateral. Collateral pledge would decrease for those borrowers who previously had to pledge extremely large amounts of collateral (firms better off); and it would increase for those borrowers with a lower level of pledged collateral before the reform (firms possibly worse off then having an extra cost after the reform).

As banks value collateral more, they may standardize the level of collateral demanded. This can create an extra cost that would be enforced on firms that had a lower level of collateral pledged before the reform. Borrowers who were signaling with lower levels of collateral will have an extra cost in signaling their quality to the bank, and those borrowers who were pledging lower levels of collateral as a disciplinary measure will incur an extra cost simply to comply with their original agreement.

The dependent variable is $Collateralization\ rate_{\ i,b,t}$ which is the value of the collateral to contract amount, winsorized on 98%/2% level of borrower *i* in quarter *t*. As discussed in Section 4, we define the two groups of firms according to their previous *Collateralization rate*. *Low-pledge firms* are firms who, before the reform, pledged, on average, an amount of collateral equal to or below the loan amount they received. *High-pledge firms*, on the other hand, are firms who, before the reform, pledged amounts of collateral that exceeded the loan amounts they received.

The most saturated specification for *Low-pledge firms* and for *High-pledge firms* is:

$$Collateralization\ rate_{\ i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Post_t + \gamma_1 W_{i,b,t} + \gamma_2 Z_{i,b,t} + \varepsilon_{i,b,t} \quad (2)$$

where *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4 and zero otherwise. The sample period starts in 2004:Q1 and ends in 2005:Q4. We also include firm–time and bank fixed effects, respectively $\alpha_{i,t}$ and α_b, controlling for unobserved time-varying heterogeneity at firm level and unobserved time-invariant bank heterogeneity. $\varepsilon_{i,b,t}$ is an idiosyncratic error term. Since the residuals may be correlated across banks and across time, we cluster standard errors at the bank level.

Vector $W_{i,b,t}$ controls for a set of observable characteristics of firm *i* with bank *b* at time *t*, including the loan amount, loan maturity, loan spread, and loan rating. Vector $Z_{i,b,t}$ controls for loan type as percentages of loans that are classified as overdraft, factoring, term loans, leasing, and export loans (Schnabl, 2012). The omitted category is regular loan. In order to check whether the inclusion of covariates reduces the impact estimated for the reform, we also show estimates of equation (2) without vector $W_{i,b,t}$ and without vector $Z_{i,b,t}$.

By using vectors $W_{i,b,t}$ and $Z_{i,b,t}$, instead of assuming that collateral is exogenous, our approach endogenizes for collateral using the jointness of several loan characteristics. Thus, we recognize that lenders do not consider each contractual agreement as an isolated debt contract feature. Instead, banks may simultaneously consider the whole contract features they can rely on. Brick and Palia (2007), and Cressy and Toivanen (2001) also consider this possibility. Our paper adds to this literature by applying firm and bank fixed effects, as we use a panel sample were we can trace the new loans of the same bank–firm combination over time. Therefore, we recognize important interrelated debt contract features including intrinsic characteristics of the relationship of the borrower with the lender.

Table 8 shows the impact of the Brazilian creditor rights reform on *Collateralization rate*. Specifications (1) to (3) account for *Low-pledge firms – Collateralization rate* equal or below one in the pre-period (Post=0). In column (1), the estimate of $Post_t$ is positive, statistically significant and economically meaningful, showing that the change to the law increased the demand for collateral of *Low-pledge firms* by 17 percentage points. Here, we include bank, and firm–time fixed effects, but do not control for time-varying bank–firm characteristics. Results are also robust when we control for time-varying bank–firm characteristics, as one can observe in column (2). A conservative estimate of the effect of the law on *Collateralization rate* for *Low-pledge firms* is an increase of 12 percentage points, as it can be found in column (3), after we add controls for the type of loans.

– Insert Table 8 here –

Specifications (4) to (6) account for *High-pledge firms – Collateralization rate* above one in the pre-period (Post=0). For these firms, we document an opposite effect of the law reform that seems to have significantly decreased the *Collateralization rate* for firms that had been pledging amounts of collateral that exceeded the value of their loans. In column (4) the

estimate of $Post_t$ is negative, decreasing the demand for collateral of *High-pledge firms* by 40 percentage points. By adding time-varying bank–firm characteristics – column (5) – and type of loans – column (6), one can observe that the estimate of the law becomes more conservative, with an estimate of 36 and 25 percentage points, respectively.

In order to test whether the results are biased because of the econometric design (*e.g.* focusing on the tails of the distribution before and after the law reform), we test prediction 3 in a placebo using a sample before the reform. The sample period goes from 2004:Q1 to 2004:Q4, where *Post* is a dummy variable that takes the value one from 2004:Q3 to 2004:Q4, and zero otherwise. Although one can argue that there is a natural tendency of the data to move to the median of the sample from one period to the next, we do not find evidence in this direction. The economic significance of the estimates we find in Table 8 is strong and reinforce the effect of the strengthening of creditor rights on a bank´s lending policy standardization.

Following the literature that analyses collateral pledge for firms with different risk levels, we tested predictions 1 and 3 by differentiating groups of firms with opposing default risk probabilities. We expected to find a heterogeneous effect of the change in the law on the different groups of firms, but we did not find evidence in this direction. Formally, we selected *Low-risk firms* that before 2005:Q1 had an average rating above the 75th percentile among all lenders. In the other sample, we selected *High-risk firms*, which before 2005:Q1 had an average rating equal to or below the 25th percentile among all lenders. By running specifications (1) and (2) for *Low-risk firms* and *High-risk firms*, we found that the estimates of *Post* are not economically and statistically significant between these two groups of firms. Results are similar when we test whether the estimates of *Post* for both groups of firms are different when setting *Low-risk firms* and *High-risk firms* by the median of the average rating of the firm with all lenders before 2005:Q1.

5.4 – Effect of bank ownership on collateral pledge

We begin testing prediction 4 by focusing on $Collateralization\ rate_{\ i,b,t}$ for *Low-pledge firms*. It may be the case that these firms in particular feel themselves in a worse off situation, given the extra cost in having to pledge more collateral after the reforms. Here we ask the question whether a certain bank-ownership type could be a strategic alternative to circumvent the extra cost imposed by the higher demand of collateral.

One challenge is the simultaneous nature of the bank and the firm behavior regarding securities interests. We completely capture any change in the supply of collateralizable assets at the firm level by using firm–time fixed effects controls, $\alpha_{i,t}$. This comes at the cost that one needs to constrain one's analysis to those firms with multiple bank relationships at the same time. In our case, we constrain our analysis to firms having a relationship with one foreign and one domestic bank (private domestic or public) in the pre- and post-period. We follow the intuition that domestic banks have an informational advantage over foreign banks, and in case of a legal change, foreign-owned banks would respond more strongly than domestic banks (Buch, 2003; Haselmann, Pistor and Vig, 2009). The most saturated specification is:

$$Collateralization\ rate_{\ i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \gamma_1 W_{i,b,t} + \gamma_2 Z_{i,b,t} + \gamma_3 B_{b,t} + \varepsilon_{i,b,t} \quad (3)$$

where vector $W_{i,b,t}$ and vector $Z_{i,b,t}$ continue being defined as in equation (2) and vector $B_{b,t}$ controls for a set of observable characteristics of bank *b* at time *t*, including size of the bank, ratio of credit assets, equity to total assets, and return over assets (Roa). Therefore, we are able to control for further bank and bank–firm specific determinants of collateral pledge not captured by the specified fixed effects. In order to check whether the inclusion of other bank and bank–firm covariates reduces the impact estimated in the baseline model, we also show estimates of equation (3) without vector $B_{b,t}$ and without vectors $W_{i,b,t}$ and $Z_{i,b,t}$. Last, but not least, since the residuals may be correlated across banks and across time (Bertrand, Duflo and Mullainathan, 2004), we cluster standard errors at the bank level.

Given the market share of Brazilian government banks and their countercyclical behavior at given moments (IMF, 2012; Coleman and Feler, 2014), one hypothesis is that government banks behave in a more detached way, compared with private domestic banks. Therefore, we also estimate the following:

$$Collateralization\ rate_{\ i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \gamma_1 W_{i,b,t} + \gamma_2 Z_{i,b,t} + \gamma_3 B_{b,t} + \varepsilon_{i,b,t} \quad (4)$$

The coefficient of interest continues to be β_1. In a difference-in-differences approach, β_1 captures the change in the demand for collateral, from the pre-treatment to the post-treatment period, for the treatment group (foreign banks) relative to the control group (private domestic and government banks in equation (3) and private domestic banks in equation (4)). A positive coefficient β_1 would imply, all else equal, that foreign banks increased their demand for collateral compared with other banks. The numerical estimate of β_1 captures the difference in the change of the demand for collateral between the pre- and the post-period induced by moving from the control group to the treatment group.

The sample period is 2004:Q1 until 2005:Q4 (quarterly data). The quarter we split the sample is 2005:Q1, which takes into account the date the new bankruptcy law was published (February 2005). Therefore, we have four quarters before the exogenous event and four quarters after it. Nonetheless, we also formally test the models for a sample period of five and six quarters after the change in the law and the results do not change. The same applies when we test for the possibility that the enforcement of the law in June 2005 is the start of the post-period.

This is a powerful identification within borrowers which is used to disentangle the bank's demand for security interests from the firm's supply of collateralizable assets. The within-firm comparison fully absorbs firm-specific changes in the supply of collateralizable assets, enabling us to defend that the estimated difference in *Collateralization rate* can be attributed to differences in a bank's demand for collateral. In order to reduce the risk that there is borrower-induced choice of multiple lenders (*i.e.* borrowers who borrow from a historically weak domestic bank try to compensate with a stronger foreign bank), we keep firm–bank relationship if it appears in the pre-period for at least three out of the four possible quarters. The same applies for the post period. Therefore, we keep the bank–firm relationship if there is a 75% minimum appearance throughout the sample period. Results are robust to the loosening of such restriction.

In a summary, we identify the impact of the bankruptcy law on the demand for collateral by comparing the pre- and the post-patterns of *Collateralization rate* applied to the same firm by two or more banks, where the firm must have a relationship with one foreign and with another bank (private domestic or public). By using bank and firm–time fixed effects, bank and bank–firm level controls, the estimated difference in *Collateralization rate* can be plausibly attributed to differences in bank behavior, depending on their ownership.

Table 9 provides the first results of prediction 4. Columns (1) to (3) show the effect of the dummy *Foreign* interacted with *Post* on the demand for collateral. In column (1), we present the results of equation (3). The estimate of $Foreign_b * Post_t$ is negative, statistically significant and economically meaningful, showing that foreign banks demanded less collateral after the law when compared with domestic banks operating in the country. Here, we include bank, and firm–time fixed effects, but do not control for time-varying bank or bank–firm characteristics. Column (2) focuses on this comparison between foreign banks and domestic banks and estimates are increased from 15 percentage points in column (1) to 23 in column (2). In column (3), we include time-varying bank controls and results remain statistically and economically significant.

– Insert Table 9 here –

In columns (4) to (6), we include the estimates of $Government_b * Post_t$ and we still observe the more "passive" behavior of foreign banks in the post period compared now to the private domestic banks. Column (6) in Table 9 presents the preferred estimation providing an unbiased estimate of the demand of foreign banks for collateral. *Ceteris paribus*, the demand of foreign banks for security interests decreased by 24 percentage points compared with private domestic banks after the reform. Because specification (6) includes saturated fixed effects, and time-varying bank and bank–firm controls, it is unlikely that the results are driven by unobservable time-varying differences in borrower demand and quality. Neither are results driven by time-invariant bank heterogeneity, time-varying differences in bank's structure, behavior or risk appetite; nor by time-varying differences in bank–firm relationship.

We run equations (3) and (4) on the full sample of 80,035 loan observations for *Low-pledge firms* and results continue to hold. The same applies when we test equations (3) and (4) for the full sample of 160,067 loans, including both *Low-pledge firms* and *High-pledge firms*. Another exercise we performed was to test whether the reform had a heterogeneous effect on the demand for different types of collateral by banks with different ownership. Using the dependent variables used to test prediction 2, we include the interaction of *Post* with *Foreign* and *Post* with *Government*. Results do not show statistically significant differences on the use of collateral agreements, with different liquidity levels across banks with different ownership.

We then test whether the reform that strengthens secured creditor rights causes secured credit to increase in a heterogeneous way, depending on bank ownership. To do this, we use the dependent variable $Secured\ debt_{i,b,t}$, defined as the ratio of outstanding credit amount guaranteed by any type of collateral of borrower *i* with bank *b* in quarter *t*. We formally estimate the following regression:

$$Secured\ credit_{i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \gamma_1 X_{i,b,t} + \gamma_2 Y_{i,b,t} + \gamma_3 B_{b,t} + \varepsilon_{i,b,t} \quad (5)$$

where vector $X_{i,b,t}$ and vector $Y_{i,b,t}$ maintain the same definition as in equation (1), but now as firm-bank-quarter level, and vector $B_{b,t}$ controls for a set of observable characteristics of bank *b* at time *t*, including size of the bank, ratio of credit assets, equity to total assets and Roa. Given the presence of government banks, we also estimate the following:

$$Secured\ credit_{i,b,t} = \alpha_{i,t} + \alpha_b + \beta_1 Foreign_b * Post_t + \beta_2 Government_b * Post_t + \gamma_1 X_{i,b,t} + \gamma_2 Y_{i,b,t} + \gamma_3 B_{b,t} + \varepsilon_{i,b,t} \quad (6)$$

Table 10 provides the main results of specifications (5) and (6). Columns (1) to (3) show the effect of the dummy *Foreign* interacted with *Post* on the demand for *Secured credit*. The estimate of 7 percentage points for $Foreign_b * Post_t$ is strong evidence that foreign banks demanded less collateral after the law reform when compared with domestic banks. In columns (4) to (6), we include the estimates of $Government_b * Post_t$, presenting our preferred estimations, which provide an unbiased estimate of the demand of foreign banks for *Secured credit*. *Ceteris paribus*, the demand of foreign banks for *Secured credit* decreased by 10 percentage points compared with private domestic banks after the reform.

– Insert Table 10 here –

Results may be driven by portfolio re-allocations, including the partial or full divestment of credit portfolios by smaller and weaker banks to bigger and stronger institutions.

As we are able to observe whether loans were acquired but not initiated by the bank itself, we are able to control for mergers and acquisitions among banks, including rebalancing of the bank's loan portfolio. Results are robust to credit portfolio movements among banks. According to Central Bank's financial stability reports, the major acquisition of a foreign bank was the purchase of the private-domestic bank Banespa by the Spanish bank Santander in June 2004. We do not find evidence that the estimates for foreign banks are driven by the activity of these two banks.

Another possible concern regarding the results is that there might be a borrower-induced choice of multiple lenders (*i.e.* borrowers who borrow from a historically weak domestic bank, try to compensate with a stronger foreign bank). In order to reduce this possibility, we keep firm–bank relationship if it appears in the pre-period for at least three out of the four possible quarters. The same applies for the post-period. However, in order to test it in a stricter sense, we account for firms with three or more bank relationships, where the firm must have a relationship with one foreign, with a private domestic bank, and with a public bank in the pre- and post-period. Even in such a setting, results continue to hold, suggesting that the main findings are not driven by the possibility of borrower-induced choice of multiple lenders.

Another possible issue is that there may be problems associated with using ratios as dependent variables in regressions, which may lead to incorrect or misleading inferences (Kronmal, 1993). In our case, the coefficients of *Foreign* and *Government* should be seen as measuring the joint effect of varying the secured loan amount and the total loan amount at the same time, on the same borrower, in comparison with private domestic banks. *Collateralization rate* and *Secured credit* in this case are the proxies we use to measure the demand for collateral. Therefore, we focus the analysis on a level variable, more specifically on the supply of credit instead of the demand for collateral. To this aim, we create the dependent variable *Total lending*, which is the natural logarithm of total loan amount of borrower *i* at bank *b* in quarter *t*. We find that the law had a homogeneous effect on lending from groups of banks with different ownership. Total credit is estimated to have increased 17% after the reform.

Results suggest that a firm's financial decisions about the allocation of security interests among creditors is strongly affected by the bank's demand for those securities. In a possible strategy to mitigate risk by increasing the liquidation value of debt contracts, after the change to the law private domestic banks tended towards retaining more collateral. Foreign banks remained as an alternative for firms that wanted to maintain part of their debt structure as unsecured.

6 – Concluding remarks

Lowering the collateral cost of capital may foster financial development. However, empowering creditors to enforce their right on collateralized assets is documented as increasing the demand for collateral. In this paper, we exploit the Brazilian bankruptcy law in a quasi-natural experiment, and investigate its effects on three aspects of collateral. Namely, we focus on corporate debt structure (macro-level), on the use of collateral agreements with different liquidity levels, and on the amount of collateral pledged in order for a firm to access new credit (micro-level).

We find that *Secured debt* increased by an estimate of 13 percentage points after the reform. Moreover, we document that the law increased the use of all types of security interests. In particular, we find evidence that the law had a bigger effect on the use of more liquid collateral agreements. Banks demand more liquid collateral because it may represent a "put option" for them, which can be exercised when the borrower defaults on a loan, with no need for the bank to integrate the bankruptcy pool of creditors. We also show that a reform that strengthens secured creditor rights has a mixed effect on borrowers, depending on their previous level of collateral pledged. Collateral pledge significantly decreases for those borrowers who previously had to pledge collateral in excess of the value of the loan, and it significantly increased for those borrowers with a lower level of collateral pledged before the reform.

We show that firms negatively affected by the reform might be able to lighten the extra burden of having to pledge more collateral. We find evidence that borrowers in a multiple banking setup could at least mitigate the effect of the reform by contracting with foreign-owned banks. Our findings are based on a careful classification of borrowers in order to disentangle the bank's demand for security interests from the firm's supply of collateralizable assets. Although the role of foreign banks is controversial, our paper documents foreign banks as promoters of financial development.

References

Acharya, V., K. John, and R. Sundaram (2011) "Cross-country variations in capital structure: The role of bankruptcy codes", *Journal of Financial Intermediation* 20: 25-54.

Acharya, V., and K. Subramanian (2009) "Bankruptcy codes and innovation", *Review of Financial Studies* 22: 4949-4988.

Aghion, P., O. Hart, and J. Moore (1992) "The economics of bankruptcy reform", *Journal of Law, Economics and Organization* 8: 523-546.

Alderson, M., and B. Betker (1995) "Liquidation costs and capital structure", *Journal of Financial Economics* 39: 45-69.

Araujo, A., R. Ferreira, and B. Funchal (2012) "The Brazilian Bankruptcy Law Experience", *Journal of Corporate Finance* 18: 994-1004.

Beck, T., A. Demirgüç-Kunt, and R. Levine (2004) "Law and firms' access to finance", *American Law and Economics Review* 7: 211-252.

Beck, T., V. Ioannidou, and L. Schäfer (2012) "Foreigners vs. natives: Bank lending technologies and loan pricing". European Banking Center Discussion Paper, 2012-014.

Bekaert, G., C. Harvey, and C. Lundblad (2005) "Does financial liberalization spur economic growth?", *Journal of Financial Economics* 77, 3-55.

Berger, A., and G. Udell (1995) "Relationship lending and lines of credit in small firm Finance". *Journal of Business* 68: 351-381.

Bertrand M., E. Duflo, and S. Mullainathan (2004) "How Much Should We Trust Differences-in-Differences Estimates?", *Quarterly Journal of Economics* 119: 249-275.

Bester, H. (1985) "Screening vs. rationing in credit markets with imperfect information", *American Economic Review* 75: 850-855.

Bester, H. (1987) "The role of collateral in credit markets with imperfect information", *European Economic Review* 31: 887–899.

Bolton, P., and D. Scharfstein (1990) "A Theory of Predation Based on Agency Problems in Financial Contracting", *American Economic Review* 80: 93-106.

Bolton, P., and D. Scharfstein (1996) "Optimal Debt Structure and the Number of Creditors", *Journal of Political Economy* 104: 1-25.

Boot, A., and A. Thakor (1994) "Moral hazard and secured lending in an infinitely repeated credit market game". *International Economic Review* 35: 899-920.

Boot, A., A. Thakor, and G. Udell (1991) "Secured lending and default risk: Equilibrium analysis, policy implications and empirical results", *Economic Journal* 101: 458-472.

Brick, I., and Palia, D. (2007) "Evidence of jointness in the terms of relationship lending", *Journal of Financial Intermediation* 16: 452-476.

Bruno, V., and R. Hauswald (2014) “The Real Effect of Foreign Banks”, *Review of Finance* 18: 1683-1716.

Central Bank of Brazil, Financial Stability Reports, various years.

Cerqueiro, G., S. Ongena, and K. Roszbach (2014) “Collateralization, Bank Loan Rates and Monitoring”, *Journal of Finance*, Forthcoming.

Chan, Y., and G. Kanatas (1985) “Asymmetric valuation and the role of collateral in loan agreements” *Journal of Money, Credit and Banking* 17: 84-95.

Claessens, S., A. Demirgüç-Kunt, and H. Huizinga (2001) “How Does Foreign Entry Affect Domestic Banking Markets?”, *Journal of Banking and Finance* 25: 891-911.

Coco, G. (2000) “On the use of collateral”, *Journal of Economic Surveys* 14: 191-214.

Coleman, N., and L. Feler (2014) “Bank Ownership, Lending, and Local Economic Performance during the 2008-2010 Financial Crisis”, *International Finance Discussion Papers* No. 1099.

Cressy, R., and O. Toivanen (2001) “Is there adverse selection in the credit market?”, *Venture Capital* 3: 215–238.

Davydenko, S., and J. Franks (2008) “Do bankruptcy codes matter? A study of defaults in France, Germany, and the U.K.”, *Journal of Finance* 63: 565-608.

Detragiache, E., P. Garella and L. Guiso (2000) “Multiple versus Single Banking Relationships: Theory and Evidence”, *Journal of Finance* 55: 1133-1161.

Diamond, D. (1984) “Financial Intermediation and Delegated Monitoring”, *Review of Economic Studies* 51: 393-414.

Djankov, S., C. McLiesh, and A. Shleifer (2007) “Private credit in 129 countries”, *Journal of Financial Economics* 84: 299-329.

Erel, I. (2011) “The Effect of Bank Mergers on Loan Prices: Evidence from the United States”, *Review of Financial Studies* 24: 1068-1101.

Giannetti, M. (2003) “Do better institutions mitigate agency problems? Evidence from corporate finance choices”, *Journal of Financial and Quantitative Analysis* 38: 185-212.

Giannetti, M., and S. Ongena (2007), “Financial Integration and Entrepreneurial Activity: Evidence from Foreign Bank Entry in Emerging Markets”, *Review of Finance* 13: 181-223.

Giannetti, M., and S. Ongena (2012) “Lending by Example: Direct and Indirect Effects of Foreign Banks in Emerging Markets”, *Journal of International Economics* 86: 167-180.

Hart, O., and J. Moore (1994) “A Theory of Debt Based on the Inalienability of Human Capital”, *Quarterly Journal of Economics* 109: 841-79.

Haselmann, R., K. Pistor and Vig, V. (2009) “How Law Affects Lending”, *Journal of Financial Studies* 23: 549-580.

IMF (2012) “Brazil: Financial System Stability Assessment”, International Monetary Fund, Country Report No. 12/206.

Jimenez, G., V. Salas, and J. Saurina (2006) “Determinants of collateral”, *Journal of Financial Economics* 81: 255-282.

Jiménez, G., S. Ongena, J. Peydró, and J. Saurina (2012) “Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications”, *American Economic Review* 102: 2301-26.

Khwaja, A., and A. Mian (2008) “Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market”, *American Economic Review* 98: 1413-1442.

Kronmal, R. (1993) “Spurious Correlation and the Fallacy of the Ratio Standard Revisited”, *Journal of the Royal Statistical Society* 156: 379-392.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny (1998) “Law and Finance”, *Journal of Political Economy* 106: 1113-1155.

Lehmann, E. and D. Neuberger (2001) “Do lending relationships matter? Evidence from bank survey data in Germany”, *Journal of Economic Behavior and Organization* 45: 339-359.

Levine, R. (1998) “The Legal Environment, Banks, and Long-Run Economic Growth”, *Journal of Money, Credit and Banking* 30: 596-613.

Levine, R. (1999) “Law, Finance, and Economic Growth”, *Journal of Financial Intermediation* 8: 8-35.

Liberti, J., and A. Mian (2010) “Collateral Spread and Financial Development”, *Journal of Finance* 65: 147-177.

Mian, A. (2006) “Distance Constraints: The Limits of Foreign Lending in Poor Economies”, *Journal of Finance* 61: 1465-1505.

Petersen, M. (2009) “Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches”, *Review of Financial Studies* 22: 435-480.

Ponticelli, J. (2014) “Court Enforcement and Firm Productivity: Evidence from a Bankruptcy Reform in Brazil”, Chicago Booth Research Paper No. 14-08.

Popov, A., and van Horen, N. (2013) “The Impact of Sovereign Debt Exposure on Bank Lending: Evidence from the European Debt Crisis”, *De Nederlandsche Bank Working Paper* No. 382.

Qian, J., and P. Strahan (2007) “How law and institutions shape financial contracts: The case of bank loans”, *Journal of Finance* 62: 2803-2834.

Rauh, J., and A. Sufi (2010) “Capital structure and debt structure”, *Review of Financial Studies* 23: 4242-4280.

Schnabl, P. (2012) “The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market”, *Journal of Finance* 67: 897-932.

Shleifer, A., and R. Vishny (1992) “Liquidation values and debt capacity: A market equilibrium approach”, *Journal of Finance* 47: 1343-1366.

Smith, C., and J. Warner (1979) “On financial contracting: An analysis of bond covenants”, *Journal of Financial Economics* 7: 117-161.

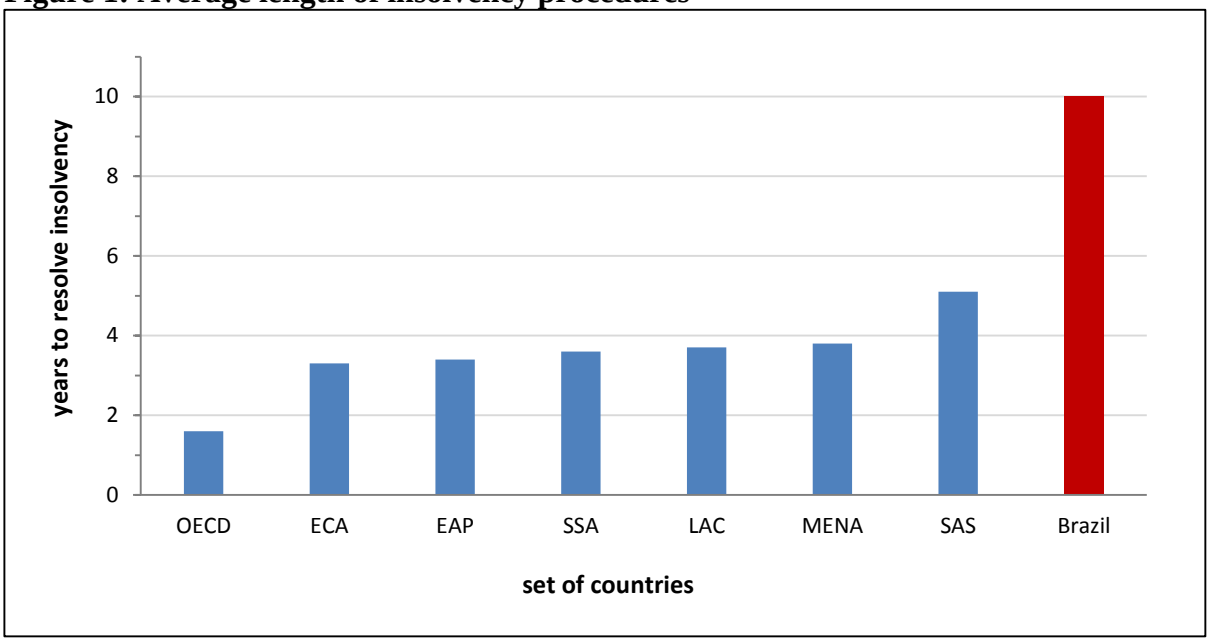
Steijvers, T., and W. Voordeckers (2009) “Collateral and credit rationing: a review of recent empirical studies as a guide for future research”, *Journal of Economic Surveys*, 23: 924-946.

Stulz, R., and H. Johnson (1985) “An analysis of secured debt”, *Journal of Financial Economics* 14: 501-521.

Vig, V. (2013), “Access to Collateral and Corporate Debt Structure: Evidence from a Natural Experiment”, *Journal of Finance* 68: 881-928.

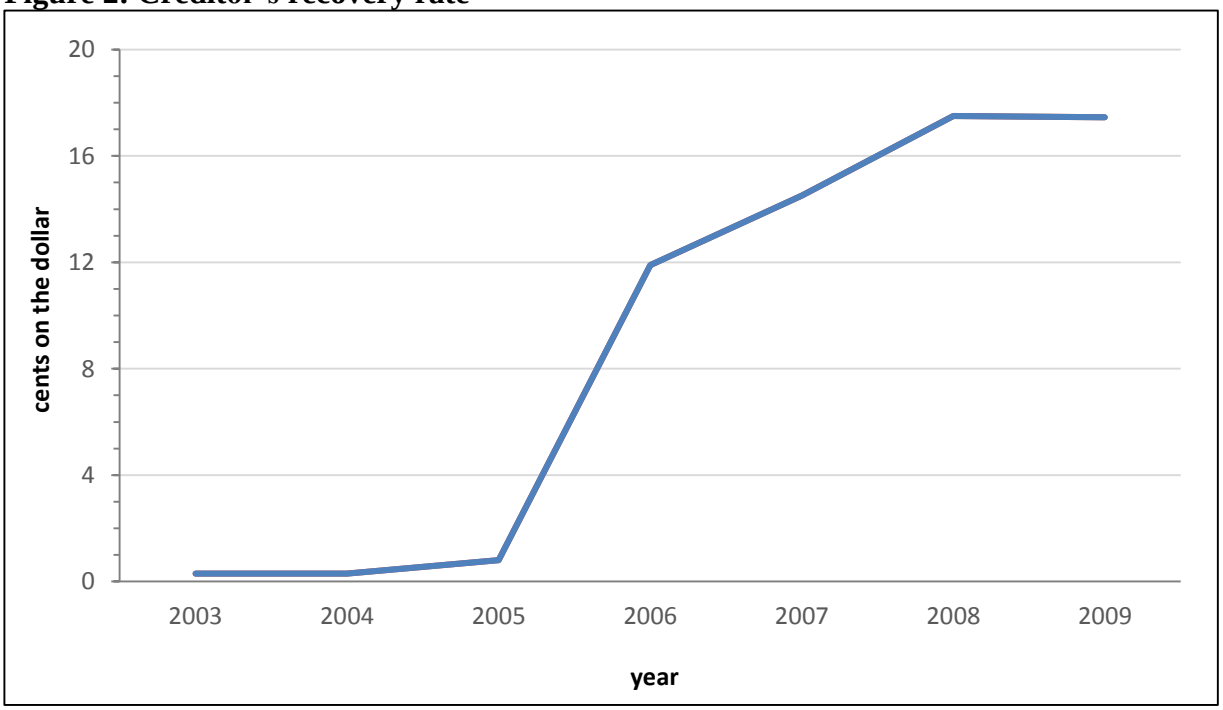
World Bank (2005) “World Development Report: A Better Investment Climate for Everyone”, The World Bank: Washington DC.

Figure 1: Average length of insolvency procedures



Source: Araujo, Ferreira, and Funchal (2012)

Figure 2: Creditor's recovery rate



Source: Araujo, Ferreira, and Funchal (2012)

Table 1
Variables definitions

The table presents the definition of variables used in the paper for each prediction. We use credit registry data, bank ownership data, and quarterly accounting information provided by the Central Bank of Brazil.

Variable name	Definition
Panel A: Variables for prediction 1 – aggregated at firm level (borrower *i* in quarter *t*), unless otherwise specified	
Secured debt	Ratio of outstanding debt amount guaranteed by any type of collateral
Post	Dummy variable that takes the value one from 2005:Q1 to 2005:Q4, and zero otherwise
Debt amount	Log of outstanding debt amount, adjusted by official inflation index, winsorized on 98%/2% level
Number of lenders	Number of active lenders
Overall rating	Weighted credit rating, which varies from 10 (lowest risk) to 2 (highest risk).
Overdraft	Ratio of amount that is classified as overdraft
Factoring	Ratio of amount that is classified as factoring
Term loans	Ratio of amount that is classified as term loans
Leasing	Ratio of amount that is classified as leasing
Export loan	Ratio of amount that is classified as export loans
Panel B: Variables for prediction 2 – aggregated at firm level (borrower *i* in quarter *t*)	
Highly liquid collateral	Ratio of outstanding debt amount guaranteed by claims under fiduciary cession agreement of credit rights and rights over banking accounts
Collateral with direct possession	Ratio of outstanding debt amount guaranteed by collateral with the direct and the indirect possession of the lender.
Collateral with indirect possession	Ratio of outstanding debt amount guaranteed by collateral with the indirect possession of the lender.
Panel C: Variables for prediction 3 – aggregated at loan level (bank *b* with borrower *i* in quarter *t*), where we only consider the first observation of each contract	
Collateralization rate	Ratio of the value of the collateral to contract amount, winsorized on 98%/2% level
Loan amount	Log of contract amount, adjusted by official inflation index, winsorized on 98%/2% level
Loan maturity	Maturity of contract in number of days, winsorized on 98%/2% level
Loan spread	Annual spread of loan contract (Interest rate – Selic target rate), winsorized on 98%/2% level
Loan rating	Rating assigned by the bank to the loan contract, which varies from 10 (lowest risk) to 2 (highest risk).
Panel D: Variables for prediction 4 – aggregated at bank-firm level (bank *b* with borrower *i* in quarter *t*), unless otherwise specified	
Foreign	Dummy variable that takes the value one if ownership control of bank in Brazil is from a foreign country, and zero otherwise
Government	Dummy variable that takes the value one if bank is public, and zero otherwise
Low-pledge firms	Dummy variable that takes the value one if firm *Collateralization rate* before the law is equal or below the sample median *Collateralization rate*, and zero otherwise
High-pledge firms	Dummy variable that takes the value one if firm *Collateralization rate* before the law is above the sample median *Collateralization rate*, and zero otherwise
Secured credit	Ratio of outstanding credit amount guaranteed by any type of collateral
Credit amount	Log of outstanding credit amount, adjusted by official inflation index, winsorized on 98%/2% level
Bank rating	Weighted credit rating, which varies from 10 (lowest risk) to 2 (highest risk).
Oldest	Dummy variable that takes the value of one if bank *b* is the oldest bank of borrower *i*, and zero otherwise
Size	Log of total assets of the bank, adjusted by official inflation index, winsorized on 98%/2% level
Credit assets	Ratio of credit assets to total assets, winsorized on 98%/2% level
Equity	Ratio of equity to total assets, winsorized on 98%/2% level
Roa	Quarterly return over assets * 100, winsorized on 98%/2% level

Table 2
Descriptive statistics for prediction 1 and 2

This table presents descriptive statistics of the variables used in the paper for prediction 1 and 2. The t-test is used to test whether the mean of the pre-period (Post=0) is the same as the mean of the post-period (Post=1).

	Overall sample					Mean		
Variable name	N	Mean	Median	St. dev.	Min	Max	Before	Diff.	T-test (p-value)
Panel A: Variables for prediction 1									
Secured debt	5,252,939	0.22	0.00	0.34	0.00	1.00	0.17	0.10	0.00
Post	5,252,939	0.51	1	0.50	0	1			
Debt amount	5,252,939	10.46	10.30	1.52	6.95	14.28	10.43	0.06	0.00
Number of lenders	5,252,939	1.61	1	1.11	1	27	1.58	0.06	0.00
Overall rating	5,252,939	8.07	8.5	1.77	2.00	10.00	8.27	−0.40	0.00
Overdraft	5,252,939	0.40	0.30	0.38	0.00	1.00	0.39	0.02	0.00
Factoring	5,252,939	0.13	0.00	0.25	0.00	1.00	0.13	−0.01	0.00
Term loans	5,252,939	0.09	0.00	0.23	0.00	1.00	0.09	0.00	0.00
Leasing	5,252,939	0.00	0.00	0.04	0.00	1.00	0.00	0.00	0.00
Export loan	5,252,939	0.00	0.00	0.04	0.00	1.00	0.00	−0.00	0.00
Panel B: Variables for prediction 2									
Highly liquid collateral	5,252,939	0.11	0.00	0.25	0.00	1.00	0.08	0.06	0.00
Collateral with direct possession	5,252,939	0.09	0.00	0.23	0.00	1.00	0.07	0.03	0.00
Collateral with indirect possession	5,252,939	0.01	0.00	0.05	0.00	0.32	0.01	0.01	0.00

Figure 3: Secured debt

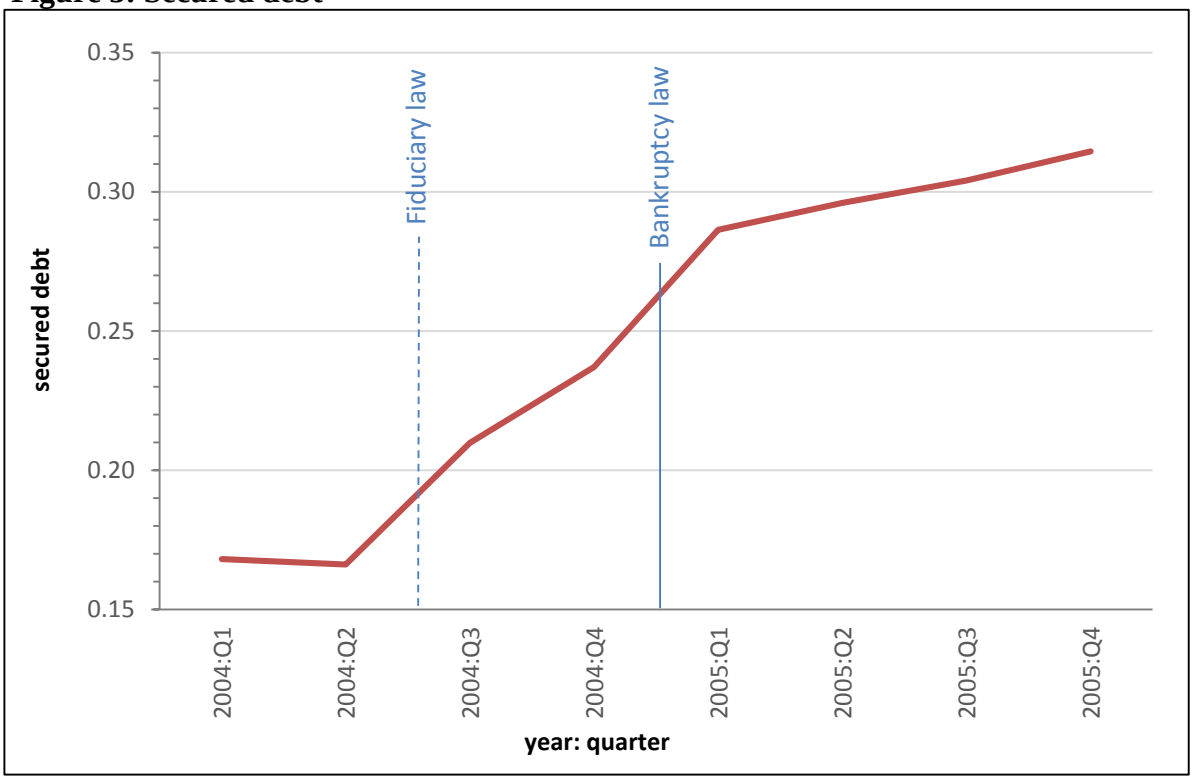


Figure 4: Type of collateral

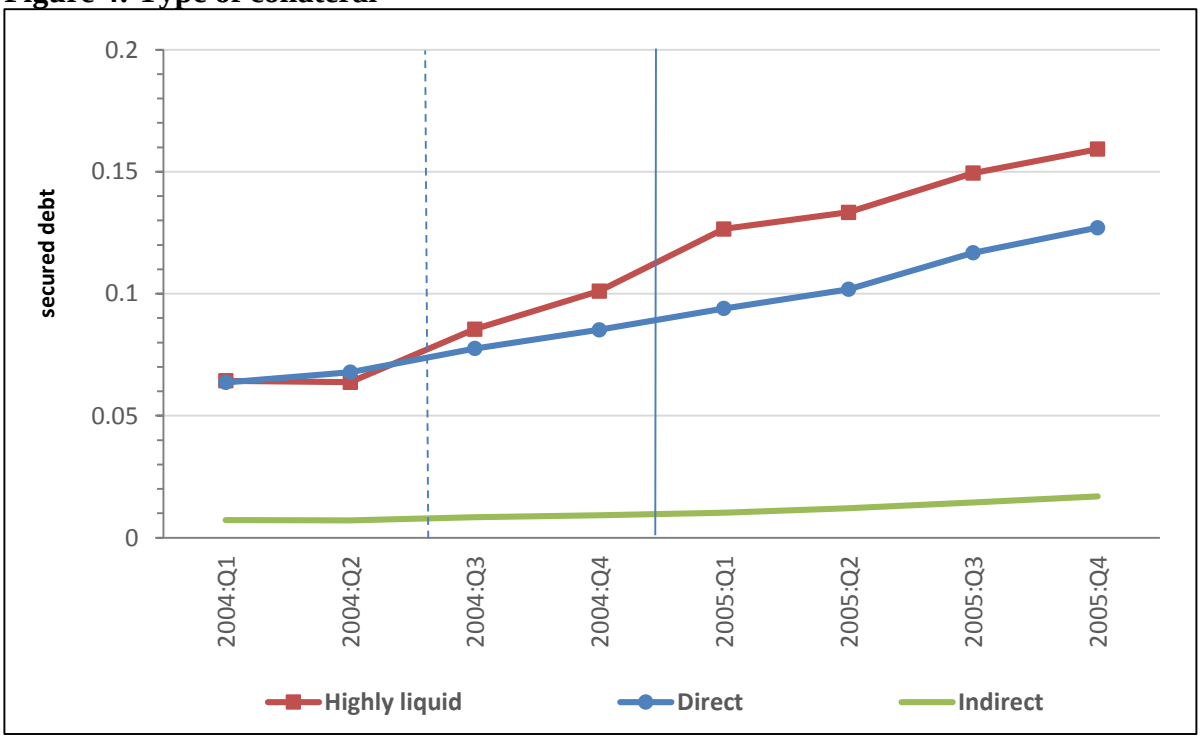


Table 3
Descriptive statistics for prediction 3

This table presents the variables used for prediction 3 for both groups of firms (*low-pledge firms* and *high-pledge firms*). We show the mean before the reform and the additional difference after the reform. The t-test is used to test whether the mean of the pre-period (Post=0) is the same as the mean of the post-period (Post=1).

	Low-pledge firms			*High-pledge firms*		
Variable name	Before	Diff.	T-Test (p-value)	Before	Diff.	T-Test (p-value)
Collateralization rate	0.95	0.14	0.00	8.25	−2.41	0.00
Loan amount	10.57	0.13	0.00	10.79	0.13	0.00
Loan maturity	147.18	6.53	0.00	162.35	25.10	0.00
Loan spread	25.76	−5.10	0.00	35.72	−10.60	0.00
Loan rating	8.20	−0.04	0.00	8.17	−0.04	0.00
Overdraft	0.17	−0.09	0.00	0.41	−0.23	0.00
Factoring	0.04	0.05	0.00	0.11	0.13	0.00
Term loans	0.14	−0.03	0.00	0.06	0.00	0.72
Leasing	-	-	-	0.00	0.00	0.32
Export loan	0.00	-0.00	0.90	0.00	−0.00	0.51
N. of observations			80,035			80,032

Figure 5: Distribution of Collateralization rate before and after the reform

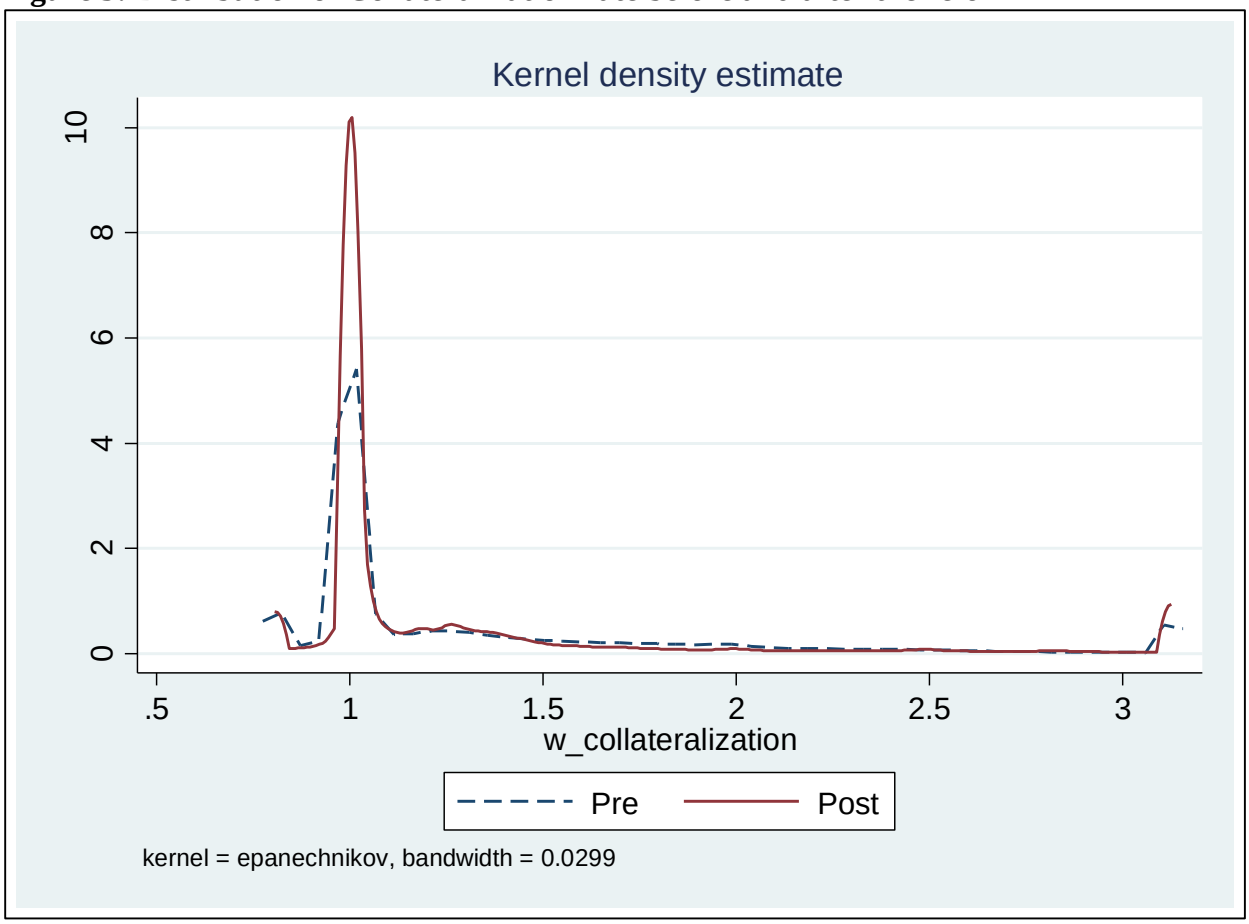


Table 4
Descriptive statistics

This table presents the variables used for prediction 4 for each group of banks. We show the mean before the reform and the additional difference after the reform. The t-test is used to test whether the mean of the pre-period (Post=0) is the same as the mean of the post-period (Post=1).

	Foreign banks			*Government banks*			*Domestic banks*		
Variable name	Before	Diff.	T-Test (p-value)	Before	Diff.	T-test (p-value)	Before	Diff.	T-Test (p-value)
Panel A: Collateralization rate for banks									
Collateralization rate	0.98	0.03	0.00	0.89	0.24	0.00	0.78	0.44	0.00
Loan amount	11.21	0.08	0.05	10.26	−0.10	0.15	11.21	0.10	0.05
Loan maturity	150.00	−12.08	0.07	208.00	16.70	0.14	80.09	122.66	0.00
Loan spread	19.14	−0.75	0.03	28.09	0.12	0.86	49.18	−23.51	0.00
Loan rating	8.22	−0.03	0.25	7.19	0.08	0.31	8.04	0.29	0.00
Size	24.49	0.02	0.47	24.45	0.01	0.58	24.67	0.54	0.00
Credit assets	0.33	0.02	0.00	0.14	0.02	0.00	0.33	−0.01	0.00
Equity	0.15	−0.02	0.00	0.07	−0.00	0.11	0.11	0.00	0.42
Roa	0.11	0.12	0.00	0.19	0.27	0.00	0.36	0.18	0.00
Overdraft	0.09	−0.02	0.00	0.13	−0.07	0.00	0.80	−0.60	0.00
Factoring	0.13	−0.03	0.00	0.01	−0.01	0.48	0.03	0.37	0.00
Term loans	0.13	−0.04	0.00	0.01	0.00	0.36	0.02	0.04	0.00
Leasing	-	-	-	-	-	-	-	-	-
Export loan	0.00	−0.00	0.19	0.00	−0.00	0.61	0.00	0.00	0.30
N. of observations			4,341			674			2,780
Panel B: Secured credit for banks									
Secured credit	0.29	0.06	0.00	0.14	0.10	0.00	0.33	0.18	0.00
Credit amount	11.42	0.06	0.00	11.19	−0.01	0.03	11.54	0.11	0.00
Bank rating	8.67	−0.58	0.00	8.24	−0.52	0.00	8.54	−0.70	0.00
Oldest	0.29	0.01	0.00	0.32	−0.00	0.05	0.32	0.01	0.00
Size	24.43	0.18	0.00	25.94	0.03	0.00	25.12	0.15	0.00
Credit assets	0.30	0.02	0.00	0.26	0.03	0.00	0.30	0.01	0.00
Equity	0.12	−0.01	0.00	0.06	0.01	0.00	0.10	0.00	0.08
Roa	0.29	0.06	0.00	0.24	0.10	0.00	0.37	0.00	0.00
Overdraft	0.41	−0.06	0.00	0.34	0.04	0.00	0.47	−0.03	0.00
Factoring	0.11	−0.05	0.00	0.28	−0.02	0.00	0.19	−0.04	0.00
Term loans	0.11	−0.01	0.00	0.01	0.01	0.00	0.11	−0.01	0.00
Leasing	0.01	−0.00	0.53	0.00	−0.00	0.14	0.00	0.00	0.00
Export loan	0.02	−0.00	0.00	0.02	−0.00	0.33	0.02	−0.00	0.00
N. of observations			452,623			295,758			401,037

Figure 6: Collateralization rate by bank ownership for Low-pledge firms

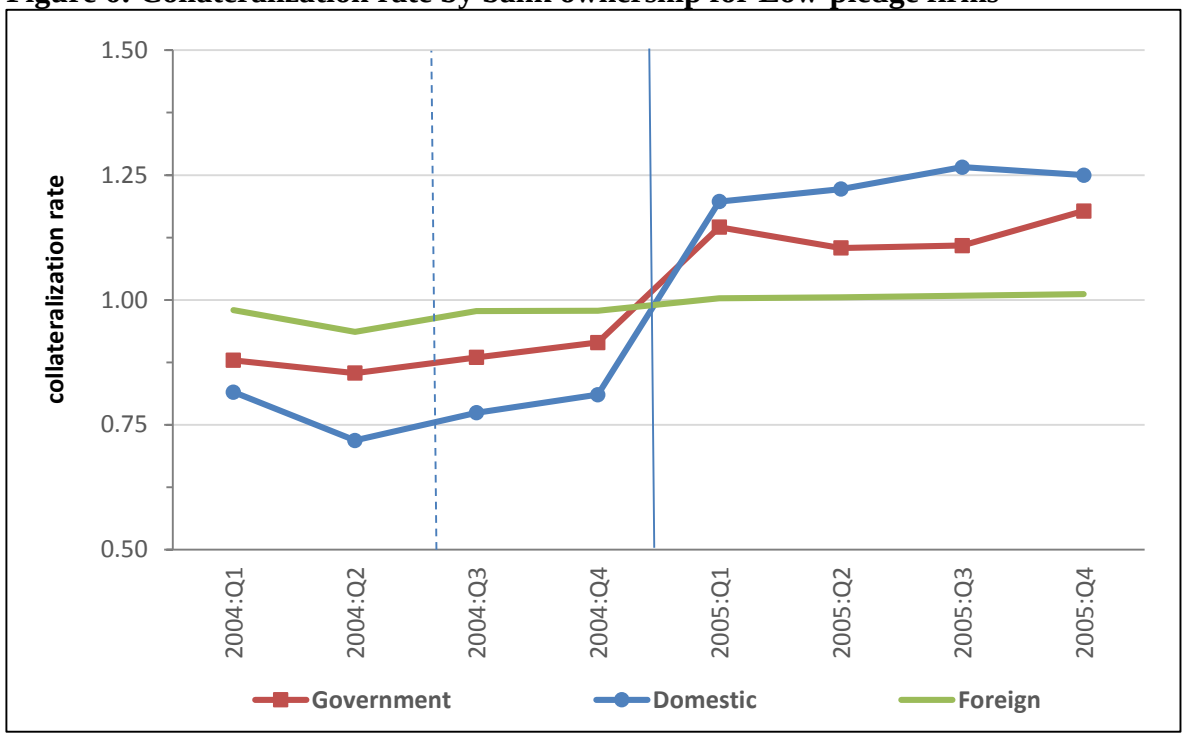


Figure 7: Secured credit by bank type

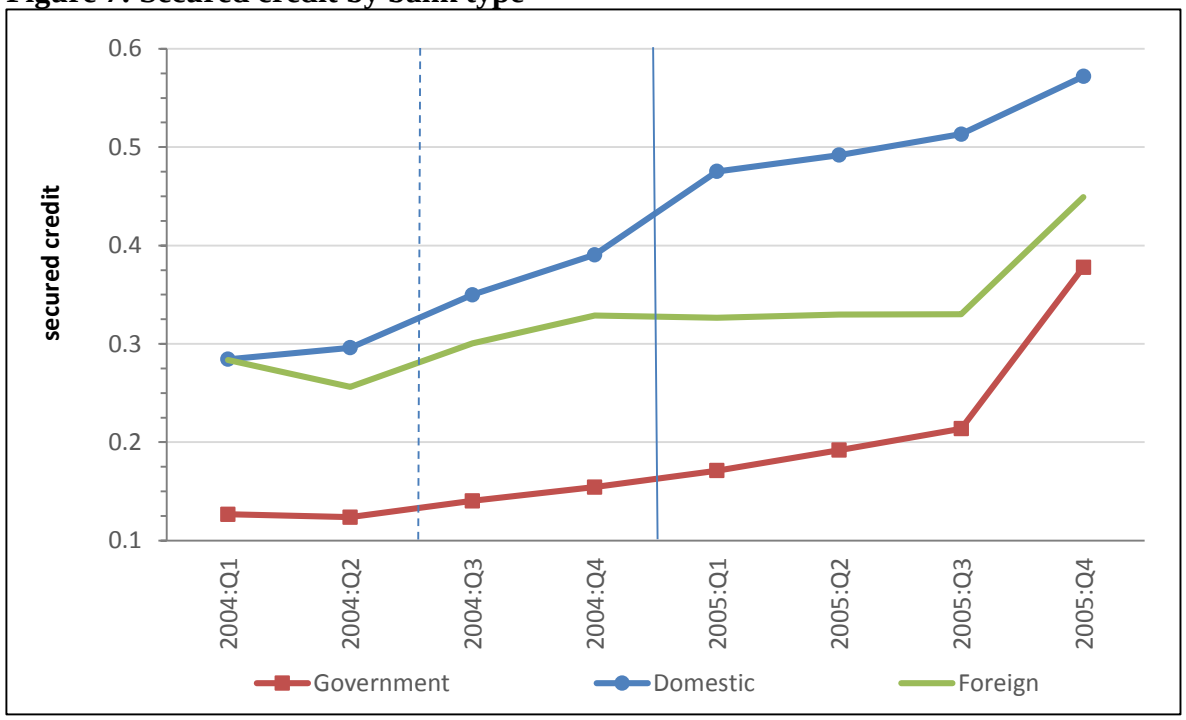


Table 5
Empirical Strategy

This table introduces the basic empirical strategy for each of the predictions. Before refers to quarters from 2004:Q1 to 2004:Q4 and after refers to quarters from 2005:Q1 to 2005: Q4. We next collapse the data into a single data point (based on averages) both before and after. This results in two data points per unit of observation, one data point for the pre-reform regime and one point for the post-reform regime. Standard errors are reported in parentheses. ***, **, * imply significance at 99% level, 95% level, and 90% level, respectively. The data spans the years of 2004 and 2005.

	Before	After	Difference	N
Panel A: Prediction 1 (Unit of observation: Firm)				
Secured debt	0.1663	0.2586	0.0923***	1,593,032
	(0.0003)	(0.0004)	(0.0005)	
Panel B: Prediction 2 (Unit of observation: Firm)				
Highly liquid collateral	0.0758	0.1330	0.0572***	1,593,032
	(0.0002)	(0.0003)	(0.0004)	
Collateral with direct possession	0.0733	0.1027	0.0294***	1,593,032
	(0.0002)	(0.0003)	(0.0003)	
Collateral with indirect possession	0.0075	0.0121	0.0046***	1,593,032
	(0.0000)	(0.0000)	(0.0001)	
Panel C: Prediction 3 (Unit of observation: Firm-bank)				
Collateralization rate for Low-Pledge firms	0.9692	1.0852	0.1160***	42,724
	(0.0005)	(0.0020)	(0.0020)	
Collateralization rate for High-Pledge firms	1.6448	1.5636	−0.0812***	45,232
	(0.0041)	(0.0047)	(0.0063)	
Panel D: Prediction 4 Collateralization rate for Low-Pledge firms (Unit of observation: Firm–bank)				
Foreign banks	1.0066	1.0360	0.0291***	2,026
	(0.0024)	(0.0050)	(0.0055)	
Government banks	1.1925	1.3124	0.1200***	444
	(0.0097)	(0.0173)	(0.0198)	
Private-domestic banks	1.1349	1.3207	0.1858***	1,532
	(0.0097)	(0.0134)	(0.0165)	
Difference (Foreign–Domestic)			−0.1419***	
			(0.0137)	
Panel E: Prediction 4 Secured credit for all firms with multiple banking relationships (Unit of observation: Firm–bank)				
Foreign banks	0.2909	0.3438	0.0529***	122,134
	(0.0014)	(0.0014)	(0.0020)	
Government banks	0.1362	0.2257	0.0895***	78,280
	(0.0012)	(0.0015)	(0.0019)	
Private-domestic banks	0.3317	0.5108	0.1791***	105,700
	(0.0016)	(0.0017)	(0.0023)	
Difference (Foreign – Domestic)			−0.0919***	
			(0.0013)	

Table 6
Effect of the reform on corporate debt structure

This table shows the impact of the Brazilian creditor rights reform on *Secured debt*. The sample period starts in 2004:Q1 and ends in 2005:Q4. *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4 and zero otherwise. Specifications (1) to (3) account for all firms, where the firm must be present in the pre and in post sample period. All regressions include firm and time fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on firmXtime level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)
Post	0.1434***	0.1332***	0.1294***
	(0.0004)	(0.0004)	(0.0004)
Firm controls			
Debt size		0.0428***	0.0593***
		(0.0002)	(0.0002)
Number of lenders		−0.0321***	−0.0493***
		(0.0002)	(0.0002)
Firm rating		−0.0117***	−0.0092***
		(0.0001)	(0.0001)
Type of loans			
Overdraft			0.0343***
			(0.0005)
Factoring			−0.2109***
			(0.0007)
Term loans			0.3187***
			(0.0012)
Leasing			−0.0572***
			(0.0055)
Export loan			−0.2036***
			(0.0072)
Fixed effects			
Time	Yes	Yes	Yes
Firm	Yes	Yes	Yes
Observations	5,252,939	5,252,939	5,252,939
R-squared	0.08	0.10	0.16

Table 7
Effect of the reform on collateral type

This table decomposes the impact of the Brazilian creditor rights reform on secured debt, depending on the lender's ability to repossess and sell the collateralizable assets. The dependent variable is *Highly liquid collateral* in column (1) to (3); *Collateral with direct possession* in columns (4) to (6), and; *Collateral with indirect possession* in column (7) to (9). The sample period starts in 2004:Q1 and ends in 2005:Q4. *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4, and zero otherwise. Specifications (1) to (9) account for all firms, where the firm must be present in the pre- and post- sample period. All regressions include firm and time fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on firmXtime level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Highly liquid collateral			*Collateral with direct possession*			*Collateral with indirect possession*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post	0.0871***	0.0845***	0.0830***	0.0468***	0.0410***	0.0389***	0.0075***	0.0062***	0.0061***
	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Firm controls									
Debt size		0.0203***	0.0351***		0.0178***	0.0174***		0.0028***	0.0038***
		(0.0001)	(0.0002)		(0.0001)	(0.0001)		(0.0000)	(0.0000)
Number of lenders		−0.0235***	−0.0307***		−0.0084***	−0.0170***		0.0012***	0.0006***
		(0.0002)	(0.0002)		(0.0002)	(0.0002)		(0.0000)	(0.0000)
Firm rating		−0.0039***	−0.0015***		−0.0062***	−0.0065***		−0.0010***	−0.0008***
		(0.0001)	(0.0001)		(0.0001)	(0.0001)		(0.0000)	(0.0000)
Type of loans									
Overdraft			0.0266***			0.0051***			0.0019***
			(0.0004)			(0.0003)			(0.0001)
Factoring			−0.1276***			−0.0595***			−0.0096***
			(0.0006)			(0.0004)			(0.0001)
Term loans			−0.1192***			0.4337***			−0.0021***
			(0.0007)			(0.0010)			(0.0001)
Leasing			−0.0947***			0.0432***			−0.0020**
			(0.0034)			(0.0045)			(0.0009)
Export loan			−0.1426***			−0.0428***			−0.0153***
			(0.0058)			(0.0039)			(0.0012)
Fixed effects									
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,252,939	5,252,939	5,252,939	5,252,939	5,252,939	5,252,939	5,252,939	5,252,939	5,252,939
R-squared	0.05	0.06	0.08	0.02	0.03	0.19	0.01	0.02	0.02

Table 8
Effect of the reform on collateralization rate

This table shows the impact of the Brazilian creditor rights reform on *Collateralization rate.* The sample period starts in 2004:Q1 and ends in 2005:Q4. *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4, and zero otherwise. Specifications (1) to (3) account for *Low-pledge firms* defined by firm *Collateralization rate* equal or below the sample median in the pre-period (Post=0). Specifications (4) to (6) account for *High-pledge firms* defined by firm *Collateralization rate* above the sample median in the pre-period (Post=0). Specification (1) to (6) accounts for loans, where the relationship of the firm and the bank must be present in the pre- and post-sample period. All regressions include bank and firm-by-time fixed effects. All regressions are estimated using OLS. All regressions include a constant, and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	Low-pledge firms			*High-pledge firms*		
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.1673***	0.1405***	0.1222***	−0.4045***	−0.3579***	−0.2472***
	(0.0103)	(0.0107)	(0.0105)	(0.0586)	(0.0673)	(0.0670)
Relationship controls						
Loan amount		−0.0992***	−0.1069***		−0.5716***	−0.5552***
		(0.0170)	(0.0188)		(0.0353)	(0.0350)
Loan maturity		0.0002***	0.0003***		0.0010***	0.0016***
		(0.0000)	(0.0000)		(0.0001)	(0.0001)
Loan spread		−0.0064***	−0.0075***		−0.0012*	−0.0062***
		(0.0002)	(0.0007)		(0.0007)	(0.0009)
Loan rating		0.0031	0.0305***		0.3279***	0.2946***
		(0.0053)	(0.0056)		(0.0286)	(0.0286)
Type of loans						
Overdraft			−0.0801			0.9807***
			(0.0599)			(0.0648)
Factoring			−0.3488***			0.7462***
			(0.0332)			(0.1459)
Term loans			−0.1832***			−0.2824***
			(0.0390)			(0.0825)
Leasing			0.0000			−1.4818***
			(.)			(0.2800)
Export loan			−0.1434***			0.0697
			(0.0488)			(0.6241)
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Firm-by-time	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80,035	80,035	80,035	80,032	80,032	80,032
R-squared	0.01	0.02	0.03	0.88	0.88	0.88

Table 9
Effect of bank ownership on collateralization rate for *Low-pledge firms*

This table shows the impact of foreign ownership on *Collateralization rate* for firms with a *Collateralization rate* before the law reform equal or below the sample median. The sample period starts in 2004:Q1 and ends in 2005:Q4. *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4, and zero otherwise. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and post-period. All regressions include bank and firm-by-time fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.1521**	−0.2339***	−0.1969***	−0.1529*	−0.2685***	−0.2380***
	(0.0668)	(0.0405)	(0.0348)	(0.0874)	(0.0504)	(0.0318)
Government * Post				−0.0039	−0.1169**	−0.1297***
				(0.0922)	(0.0543)	(0.0427)
Relationship controls						
Loan amount		−0.0354***	−0.0339***		−0.0355***	−0.0341***
		(0.0072)	(0.0074)		(0.0071)	(0.0073)
Loan maturity		0.0002***	0.0002***		0.0002***	0.0002***
		(0.0000)	(0.0000)		(0.0000)	(0.0000)
Loan spread		−0.0016**	−0.0015***		−0.0015**	−0.0014***
		(0.0006)	(0.0005)		(0.0006)	(0.0005)
Loan rating		0.0105	0.0119		0.0102	0.0110
		(0.0093)	(0.0099)		(0.0095)	(0.0099)
Type of loans						
Overdraft		0.0242	0.0337		0.0338	0.0435
		(0.0381)	(0.0367)		(0.0340)	(0.0343)
Factoring		−0.3829***	−0.3612***		−0.3895***	−0.3674***
		(0.0477)	(0.0367)		(0.0499)	(0.0381)
Term loans		−0.0502	-0.0423		−0.0490	−0.0403
		(0.0307)	(0.0270)		(0.0307)	(0.0273)
Export loan		−0.0419	−0.0814		−0.0479	−0.0875
		(0.0839)	(0.1004)		(0.0845)	(0.1002)
Bank controls						
Size			−0.4334*			−0.4804**
			(0.2291)			(0.2297)
Credit assets			−0.6265			−0.5413
			(0.5599)			(0.5357)
Equity			0.7104			0.4190
			(0.5017)			(0.5879)
Roa			−0.0760***			−0.0721***
			(0.0126)			(0.0128)
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Firm-by-time	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,795	7,795	7,795	7,795	7,795	7,795
R-squared	0.29	0.34	0.35	0.29	0.34	0.35

Table 10
Effect of bank ownership on secured credit

This table shows the impact of foreign ownership on *Secured credit.* The sample period starts in 2004:Q1 and ends in 2005:Q4. *Post* is a dummy variable that takes the value one from 2005:Q1 to 2005:Q4, and zero otherwise. Specifications (1) to (6) account for firms with two or more bank relationships, where the firm must have a relationship with a foreign and with another bank (private domestic or public) in the pre- and post-period. All regressions include bank and firm-by-time fixed effects. All regressions are estimated using OLS. All regressions include a constant and standard errors are clustered on bank level. Standard errors appear in parentheses and ***, **, * correspond to one, five and ten percent level of significance.

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign * Post	−0.0747**	−0.0834**	−0.0733**	−0.1132**	−0.1172**	−0.1038**
	(0.0369)	(0.0368)	(0.0344)	(0.0511)	(0.0512)	(0.0488)
Government * Post				−0.0890*	−0.0786	-0.0719
				(0.0529)	(0.0521)	(0.0506)
Relationship controls						
Credit amount		0.0661***	0.0664***		0.0658***	0.0662***
		(0.0057)	(0.0056)		(0.0057)	(0.0056)
Bank rating		−0.0041	−0.0039		−0.0037	−0.0036
		(0.0040)	(0.0040)		(0.0041)	(0.0040)
Oldest		0.0025	0.0023		0.0024	0.0024
		(0.0037)	(0.0037)		(0.0037)	(0.0037)
Type of loans						
Overdraft		0.0041	0.0061		0.0070	0.0083
		(0.0277)	(0.0271)		(0.0274)	(0.0269)
Factoring		−0.3709***	−0.3691***		−0.3683***	−0.3669***
		(0.0428)	(0.0423)		(0.0427)	(0.0422)
Term loans		0.2721***	0.2735***		0.2746***	0.2752***
		(0.0747)	(0.0744)		(0.0742)	(0.0740)
Leasing		−0.1506*	−0.1516*		−0.1499*	−0.1506*
		(0.0856)	(0.0864)		(0.0856)	(0.0862)
Export loan		−0.2785***	−0.2773***		−0.2759***	−0.2753***
		(0.0515)	(0.0511)		(0.0504)	(0.0502)
Bank controls						
Size			0.0515			0.0260
			(0.0569)			(0.0562)
Credit assets			−0.5356**			−0.4070**
			(0.2189)			(0.1818)
Equity			1.3449***			1.1742***
			(0.3488)			(0.3723)
Roa			0.0205			0.0227
Fixed effects						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Firm-by-time	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,149,418	1,149,418	1,149,418	1,149,418	1,149,418	1,149,418
R-squared	0.23	0.32	0.32	0.24	0.32	0.32